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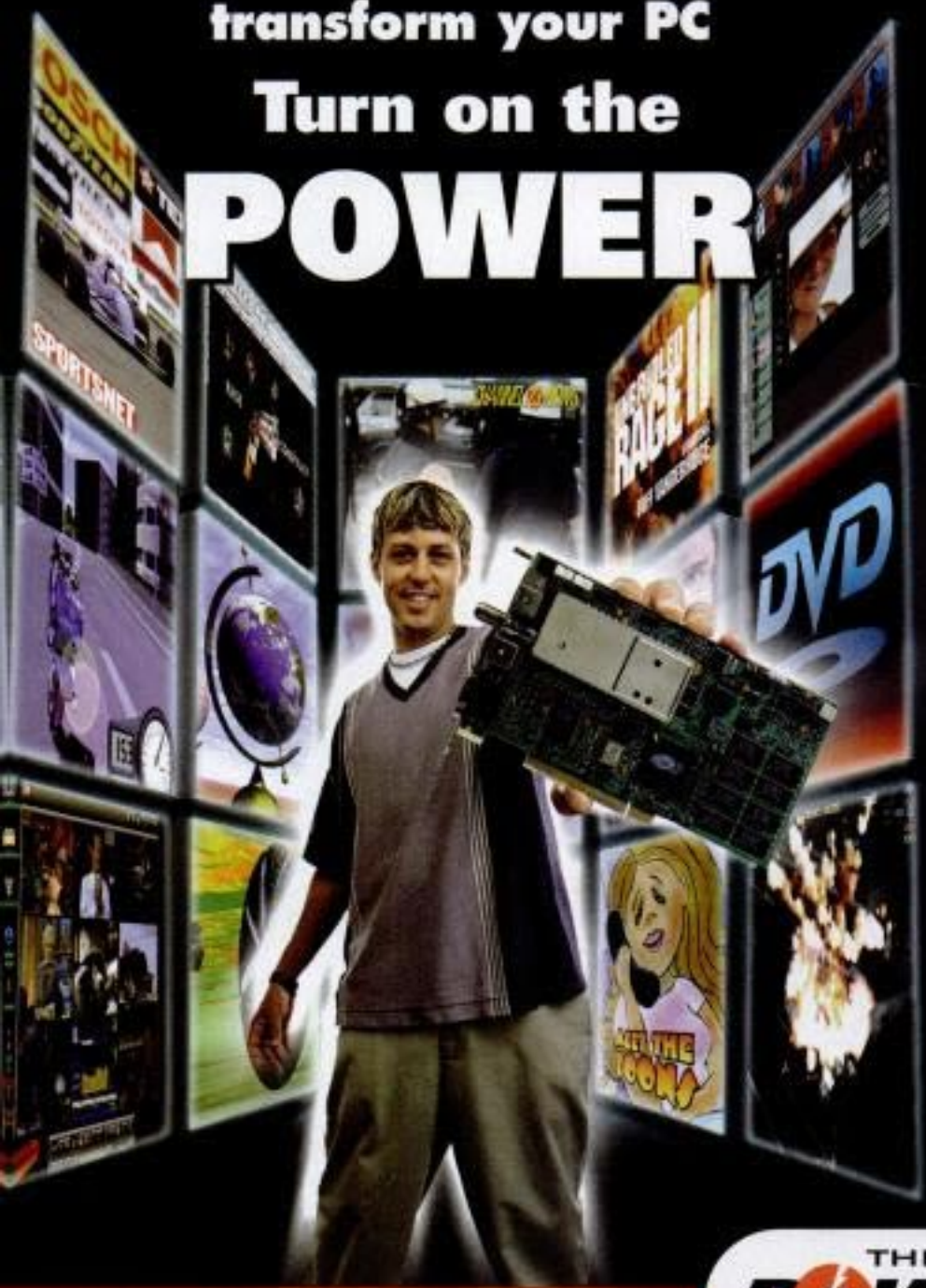

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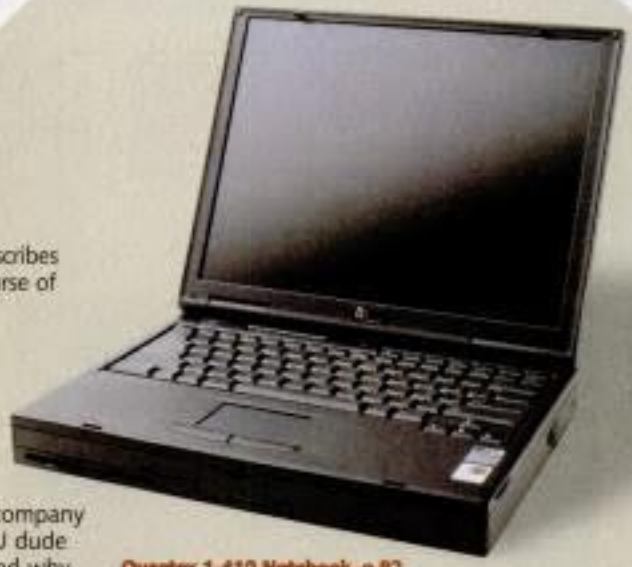
Don Francisco's livin' la video loca



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EDWORD

How We Saved $5,000

You now hold in your hands the most hotly anticipated issue of the year. Once every 365 days, we amass our collective *Maximum PC* expertise and assemble the Dream Machine. But this year, we're taking a fresh approach.

First things first, though; some background is called for.

The proud Dream Machine tradition harkens back to September 1996, and the premiere issue of *boot* magazine. We ponied up $5K and set out to build the ultimate PC as a symbol of our dedication to the Pure PC Power mantra: vanilla 200MHz Pentium, 32MB RAM, a 4MB Matrox video card, a 2GB SCSI hard drive, a 4x CD-ROM drive, SB AWE 32 and Altec Lansing speakers, topped off with a 17-inch monitor.

Frankly, the first Dream Machine sucked, even for its day. It's hard to believe we spent five grand for that dog.But we've learned a lot since then.

Subsequent Dream Machines stepped up and schooled the industry on exactly how a monster machine should be assembled. Handpicked, top-of-the-line parts came together to blast through all our benchmark records and provide a blueprint for savvy system-makers.

Then came Dream Machine 98. We brashly challenged a big-name company and a local system maker to each create a $5,000 system that could beat ours. And they did.

The world had changed. The ruthless price wars in the tech sector had driven costs down so low that, given their volume rates, even the small local company could throw obscene amounts of force at our Dream Machine. With up to 384MB of RAM, CD-R drives, and 21-inch monitors, the competitors' mean machines threatened to blow our challenger out of the water. Luckily, genius design decisions (and a little overclocking magic) kept us solidly in the hunt; Dream Machine 98 took the bootMark, 3D rendering, DTP, and OpenGL contests by a narrow margin, and fell just one fps behind in the Direct3D battle.

But we had seen the future, and it didn't look rosy for the Dream Machines to come.

Meanwhile, another issue reared its head. In addition to building an überPC every September, we've established a tradition of naming the best products of the year every December, in our Gear of the Year rundown. But after selecting the pick of the litter for the Dream Machine, we felt forced three months later to be either redundant or inconsistent.

So this year, we've taken a different tack.

We brashly challenged a big-name company and a local system maker to each create a $5,000 system that could beat ours. And they did.

Every year, after we run the delectable list of delicious fixin's in our Dream Machine article, we've received droves of letters that basically say, "Thanks for the ingredients, now all I need is a recipe." So, instead of focusing this month's feature on the parts, we're focusing on the hows and whys of building your very own Dream Machine.

Flip over to page 50 for the ultimate step-by-step guide to building the machine of your dreams, and look forward to our take on the Gear of the Year at year's end.

Keep telling us what you need to burn maximum megahertz and we'll keep pumping out the best magazine to help you do it to it.

Brad "Big Daddy" Dosland
Editor in Chief

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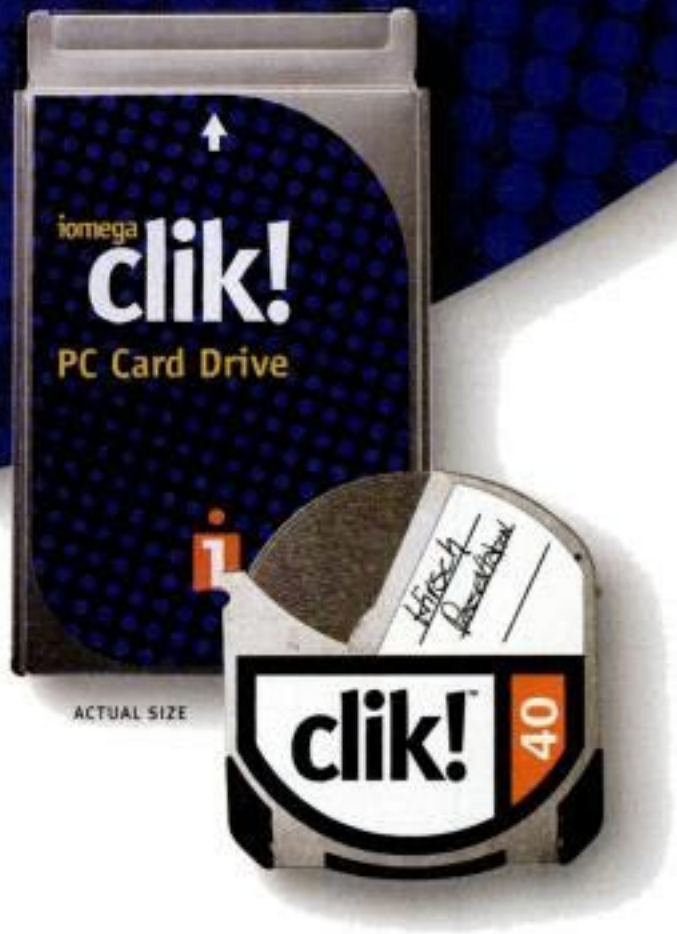

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system shock 2

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Letters from the Smartest Readers in the World

Here's the deal: You (being the smartest readers in the world) write letters about the magazine, the PC industry, the software you love or hate, and the hardware that runs it. We read it and share as much of it as space permits in the mag and online, and respond or comment when the letter calls for it. Get it? Now get busy and write us at **commport@maximumpc.com**

PC Parts on the Cheap

Is it legal for a retailer to sell OEM parts? From what I understand, OEM parts are intended for companies that build and sell computers as their own, such as Dell, Micron, etc. I've never seen any of these companies selling off individual hard drives or video cards. Is it reliable to purchase these parts from local retailers?

—MadMattz

News Editor Gordon Ung replies: It isn't technically legal for retailers to sell parts intended for system integration, but the practice is so widespread that most companies don't appear to care. Saving money is nice, but there are risks when buying OEM or "whitebox" parts. Warranties that cover regular retail parts may not cover OEM parts. Software bundles might not be complete. And the worst-case scenario: Some OEM components use either lower-quality or slower parts, or omit key features that appear in their retail counterparts. You might be able to score a nice deal, but exercise caution.

"I'm glad somebody with some clout has exposed fraudulent computer products."

My RAM is Bunk

I'm glad somebody with some clout has exposed fraudulent computer products. Your June 99 cover story answered questions about the type of RAM in my system and why my computer keeps crashing. I always suspected the RAM, since it was the only product in my computer I couldn't verify on the manufacturer's web site. Now you've confirmed it! I have the exact RAM pictured on page 52—256MB worth! I'm going to deal with the supplier as best I can since I now know that a lot of the stuff at computer fairs isn't what it seems.

—Okan

MD: Mostly Dead

Why can't the PC industry incorporate Sony's MiniDisc technology for data back-up in the same way that CD-Rs or CD-RWs work? MiniDiscs can be re-recorded on up to a million times, they're fast, and they can hold 74 minutes of audio. Shouldn't it hold 650MB of data as well?

—LiteSpeed

Technical Editor Sean Cleveland replies: Actually, the MiniDisc has nothing on the Compact Disc since it can't hold 650MB of data and can't record 74 minutes of CD-ROM-quality music. Although the recording density of the MiniDisc is on par with the Compact Disc, the smaller diameter of the MD can hold only one-fifth the data of a CD. We haven't played with a MD removable storage drive yet, but the spec sheets claim that the capacity tops out at 140MB. MiniDisc audio and data formats share similar specs, but Sony is currently working to improve the data quality and transfer rates of the MiniDisc Data format, as well as altering the cartridge shape in order to avoid confusion between the two formats.

The magneto-optical recording technology used by the MiniDisc supports the ability to move and erase songs on the fly, something the cassette tape—for which the MiniDisc was developed in 1992 as a replacement—can't do. To pack an entire CD's worth of music on a MD, Sony employed ATRAC audio data compression, which takes 48kHz of CD-quality music and converts it to 44.1kHz. With any compression scheme, audio quality is reduced, and many audio aficionados argue that the reduction is noticeable. But as a side benefit, the decreased quality of MiniDisc music keeps the recording industry off Sony's back.

Even with the traits that make it popular today—including its small size, shock-resistant memory, and MO recording technology—the MiniDisc really doesn't stand a chance as a removable storage device. Its media size is just too small and wouldn't be compatible with MiniDisc audio players. And in light of the recent rise of CD rewritable technology, the MD's future doesn't look good on the audio side, either.

Digital DeMille

We're currently shooting a movie on Super 8 cassettes and converting it over to VHS tapes. We've got audio mixing down pretty well—we're running it through our Montego and SB Live! cards, mixing it in *Audio Station*, and running it out to our VCR. The next step is special effects.

In the grand scheme of things, I know this movie is about as significant as my grandmother's homepage, but we're both into film, so we'd like to create something we can show around as a résumé piece. Basically, we need to get our Super8 or VHS frames into the computer so we can edit them with

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This month:

- Have you seen this RAM?
- Loss of id
- Half-Life nausea
- Letting go of an old friend

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AfterEffects or *Premiere* or the like. We have about $500 dollars total to spend.

—Andy and James

Reviews Editor Rick Popko replies: Personally, Dave, I'm addicted to FireWire, because you can edit digital tape multiple times and it will still look as good as the original. But you're using Hi8, which means you're going to want some kind of a motion-JPEG solution. If you're on a budget, you might check out Matrox Rainbow Runner or the All-in-Wonder 128. These $200+ multipurpose cards act as your 2D/3D graphics cards and video capture devices. Know, though, that you get what you pay for—I'm not all that impressed with the quality of the video produced by either card.

The next step up the DV ladder is Pinnacle Systems' DC20Plus, and above that is the DC30Plus—the one I'd buy. While the DC30Plus sets you back about $900, it comes with the full version of Adobe *Premiere* (a $600 value). Whatever you choose, make sure you call the company before you plunk your money down, to make sure the board has been tested with the K6.

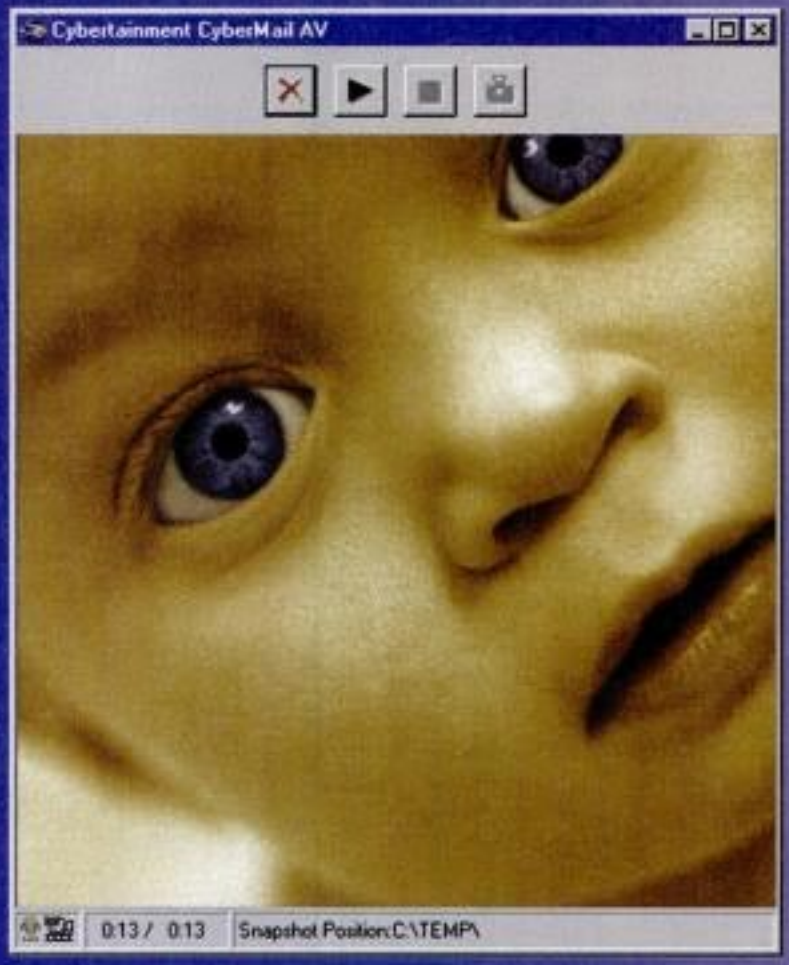
Hope this helps. Good luck on your project and keep us in mind for cameos.

id's Decline and Fall

id Software is no longer the best game company. Out of the box, *Doom* was 100% playable and the subsequent patches fixed the few bugs ever encountered. *Doom II* was just *Doom* with a double-barrel shotgun. Then there was *Final Doom—Doom II* with more levels.

Up to this point, the decline was very slight. Then came *Quake*. If it weren't for the mod community and the addictive multiplay, *Quake* would have bombed. id simply blamed John Romero's non-stop deathmatching as the reason for all of the game's faults. But then came *Quake II*, with which id promised everything and ended up delivering utter crap. But since the original did so well, people bought it. Had *Quake II* been a freshman effort like *Sin*, it would have ended up in the same bargain bins that *Sin* is in now.

Now we have *Quake III: Arena*. Will this game continue the decline and fall of id Software or will it bowl us over as the revolutionary new wave of deathmatch-only games? From what I've seen



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of the test, it still needs a lot of work if it's going to reverse the id decline.

—LoneGunMan

Allergic to Half-Life

When I play first-person shooters such as *Quake* and *Half-Life*, I just look at the game and get dizzy and nauseous. Is there any explanation for why this happens? Is this an isolated account or a common occurrence? What's the solution? Am I *Doomed*?

—Kenny Han

Associate Editor Josh Norem replies: Getting nauseated while playing video games is common if the games have titles that begin with the words extreme or redneck, but when kick ass games such as *Half-Life* and *Quake II* cause problems, you'd better take notice. For a long time, video games have been described as the cause of the types of problems you describe. Doctors believe that games with repetitive, high-intensity, multicolored or white flashes can trigger physical reactions called reflex-attack seizures. Fatigue and sleep deprivation may also be contributing factors.

"When I play first-person shooters such as Quake and Half-Life, I just look at the game and get dizzy and nauseous."

This is hard for me to say, Kenny, but if you are experiencing any of these symptoms, I recommend you avoid playing video games. I also recommend you get a conclusive analysis from a professional, since video games typically cause such reactions in people with epilepsy. Don't get too concerned though, as it's possible your body just isn't made to handle games, just like some people get seasick or carsick. Scientists also say some benefits might be gained from sitting further away from the screen or wearing tinted glasses, though results vary from case to case.

The Big Lie

Well, it's now official. The only thing "NT" could stand for with regard to Windows 2000 is "Never Trust" Redmond. Despite two years of press releases by Microsoft that promised the contrary, Windows 2000 Consumer is not based on 32-bit NT code. Rather, it's another extension of the Windows 95 16-bit OS, comprised of over 22 million lines of code—meaning it's even more bloated than Windows 98!

Once you cut through all of the gobbledy-gook from the Redmond PR office, it boils down to what I suspected when the release date kept slipping—that merging the direct-to-hardware 32-bit NT OS with the direct-to-hardware Direct X API is a nearly impossible task for Microsoft's programmers.

Anyone with half a brain could have told them that a Ferrari transmission won't bolt up to a Humvee engine.

I don't know why they didn't simply start with Direct X and build an OS around it, then create a sub-OS shell extension for backwards compatibility. This approach would have ensured compatibility, extensibility, and scalability, and the end product would have been small and clean, code-wise.

Overlooked in all of the hoopla and outrage is the simple fact that Microsoft cannot create a stable, pure 32-bit OS for the home user. So what makes anyone think they'll be able to create an acceptable 64-bit OS when the first 64-bit processors arrive at the end of the year?

Linux is looking more and more like a legitimate OS contender. I'll even go way out on a limb here and predict that Torvalds or some other group in the Linux community will come up with a 64-bit OS within the next 18 to 20 months, and that it betas before anything Microsoft comes up with.

—Vern Earlywine

Maximum Irreverence

Saw an issue of *Maximum PC* today that misuses the Iwo Jima flag-raising photo on its cover. If you were attempting to show your irreverence by defaming one of our country's most respected monuments, you succeeded. Don't know how others have reacted, but you lost this customer.

Enjoy that freedom of speech, son. I'll enjoy my freedom of choice.

—Mike Shay

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Maximum Marines

As a networking technician for the United States Marine Corps, I'm in the process of creating a new web page for our computer section on base, here in 29 Palms, CA. I was hoping I might be able to use the two Jima/Video Card graphics from the last *Maximum PC* cover. It perfectly portrays me and the Marines I work with.

—Cpl Aragues, USMC

Truly Anonymous E-Mail

I recently set up an account with Hotmail in order to correspond with some people I met in chat rooms on the web. I set up the account to guard my privacy. However, I noticed that with Hotmail I could display advanced headers, which show the originating IP. If I take that number and go to an IP search site on the Internet, I can receive the provider of the service. This was a surprise to me.

Should I be paranoid that I leave a fingerprint every place I go? Is there a way to keep your originating IP from being transmitted with e-mail?

—Larry Miller

News Editor Gordon Ung replies: For general flaming, you'd be okay if you used a dial-up account. Most ISPs assign dynamic IPs, so they rotate every time you log in.

Having your IP shown in the header can easily lead the FBI, the Microsoft police, or the hacker you've been flaming to your door in no time. There's a few ways to reduce the chances that you'll have to move: First, use only public terminals, like those at a public library, to access Hotmail—and make sure there are no surveillance cameras, traffic cameras, or ATMs nearby that could capture your face on tape. Don't consider a disguise to be out of the question. Second, surf using a privacy-conscious web-browsing service, such as Anonymizer.com. It should strip your IP, browser type, and any particulars out, and make you fairly immune on Hotmail, because if Hotmail doesn't have your IP, it can't pass it on. Keep in mind, though, that entities such as Anonymizer.com would have to open their books and logs if faced with a court order.

Coping With a Loss

I am writing today to inform you of some difficult news. On Sunday, June 27, 1999, I said farewell to a friend who had stood by me through most of my life. My 1985 Zenith Z-100 PC left my house this Sunday for the Salvation Army, where it will probably be thrown away as a piece of junk. But this machine is not a piece of junk. She outlived a Mac Plus and a 486, both of which were supposed to be her betters.

To call her mine is even unjust. She was her own computer—she never crashed, and she always greeted you with a warm yellow glow every time you hit the button on the back of her case. Her yellow characters saw two dogs come and go, the fall of the Berlin wall, and the Packers win their first Super Bowl in 30 years.

She was a survivor from a different age. An age when it wasn't the graphics or download speeds that mattered, but being able to really interact with a machine. Even though I own games such as *Half-Life* and *Starcraft*, there were still many nights that I would spend my time playing *Galaga* or *Centipede*. I grew up with this machine and it played a part in making me the rowdy teenager I am today.

Thank you for your support in this difficult time.

—Ben Hutchens

"Though my family is hardly a group of Puritans, we have taught the children that swearing and use of vulgarities is not acceptable."

Secure Plug and Play

In the Fast Forward column describing the UPnP and Jini technologies, you made the comment: "Ideally, you should be able to attach a small device such as a handheld computer to a network, quickly use any service that's available (such as a printer), then detach the device and walk away—without installing and uninstalling a driver."

I don't know enough about these technologies so perhaps this is just my ignorance shining through, but doesn't this seem like a huge security problem? Picture it this way: connect to the network, drop your virus/steal documents, disconnect and walk away. It sounds like trouble to me. And if there are security measures in place, won't it still detract from the ease of use that Sun and Microsoft are proclaiming these technologies will bring? Security is a complex issue that should not be compromised by ease of use.

—Breen Ouellette

Columnist Tom Halfhill replies: Of course, in a secure environment, not just anybody can plug a device into the network and start hacking away. You'll have to enter a password, just like you do now. That won't detract from the ease of use because it's not an extra step. Passwords are routine on secure networks. Sun and Microsoft are very aware of these concerns and are building security into Jini and Universal Plug and Play.

In fact, Jini and UPnP could make things more flexible for network administrators in this regard. An administrator could set up a network to allow visitors to use a printer or a particular server without giving them access to the rest of the network. This could save administrators the trouble of setting up special accounts for temporary guest users.

I hope this answers your question. If not, visit the Sun and Microsoft web sites to learn more about the security features in Jini and UPnP. I think Sun has a whole white paper on the subject.

9-Year-Olds Kick Ass

My 9-year-old nephew is visiting us; today, he came into my office and saw my new Dell computer. He told me that the new Dell computers "kick ass."

I was rather astonished that he used such language, and I asked him where he learned what he just stated. Though my family is hardly a group of Puritans, we have taught the children that swearing and use of vulgarities is not acceptable. He informed me that he had been looking at my new *Maximum PC* magazine, and that's what it said.

There it was, right on the cover of the July 99 issue: "Dell's 550MHz Pentium III kicks ass!" On page 86 it was rated as a "kick ass" product. It is a positive quality that my nephew wants to learn about computers, yet I'd like for him to be able to do it without learning language that we don't want him to use.

—Gary T. Johnson ●

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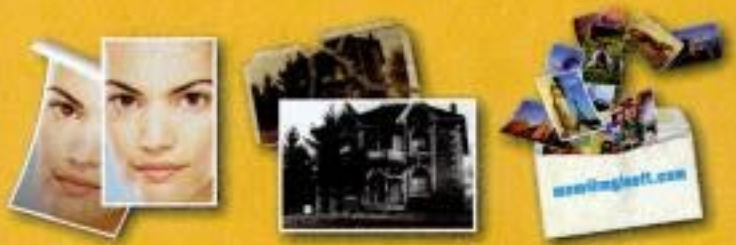

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	56K ITU V.90 Modem[4]	56K ITU V.90 Modem[4]
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56K ITU V.90 Modem[3]	56K ITU V.90 Modem[3]	56K ITU V.90 Modem[3]	56K ITU V.90 Modem[3]
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3D Merge Overkill

Will consolidation in the videocard industry leave consumers with slim pickings?

Two years ago, the graphics card section of your typical computer store looked like the cereal aisle of your typical grocery store, complete with orange and white STB boxes, silver Canopus boxes, and purple Quantum 3D boxes.

Push your cart down that same aisle today and you'd think you were shopping for tissues—the choices are Kleenex, Kleenex, and Kleenex. Gone are STB's TNT cards, Canopus' Voodoo^2, and Quantum3D's dual-Obsidian card.

And it looks as though the pickings are going to get even slimmer. In June, Veteran chipset maker S3 announced that it had purchased top retail-card vendor Diamond Multimedia. And like 3dfx's purchase of STB Systems in December ended STB's relationship with nVidia, Diamond will most likely divorce itself from nVidia and the Viper 770 Ultra.

For PC fanatics, it's as if the Florida Marlins bought the Cleveland Indians but are claiming that nothing will change.

"This is nothing but bad for us, the consumer," lamented one person on *Maximum PC*'s discussion forums.

Creative Labs' Steve Mosher concurs, predicting that the mergers won't only hurt choice—they'll also hurt your pocketbook.

"We introduced the Voodoo^2 at $299 in November of 1997, but with the competition between Diamond and Creative Labs and Canopus and Metabyte and STB and Orchid—the list goes on—the prices were driven down to $199 by Christmas," Mosher says.

And you can also wave good-bye to options: Voodoo^2 boards, like TNT boards, were once offered in 12MB and 8MB versions. Some had cooling fans, some didn't. Quantum3D, a company founded by former 3dfx employees, even offered two Voodoo2 boards welded together on a single card.

"You had boards with TV, you had boards without TV, you had boards that were overclocked—you had everything under the sun. People could pick and choose what they liked," Mosher says.

As Diamond walks the tightrope of technology, fans wonder if S3 will be there to catch them.

Friends, those days are gone. Now 3dfx offers just two flavors: high and medium performance. Not that Creative Labs is free of guilt. Creative has already said it won't renew its contract with S3, and plans to let the 3D Blaster Savage 4 fade away.

While consumer choice and pricing are of concern, other Diamond competitors wonder whether the deal makes any sense at all.

"[S3 and Diamond are] choosing to compete with Cisco,

ILLUSTRATION BY SCOTT PICK

SPIN CYCLE This month's top stories broken down ►

HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Alpha Hits 1GHz	Pentium III at 1GHz? Feh. Samsung's Alpha Computer, Inc. has done the same without using super cooling to achieve it.	At PC Expo, API showed off a stable box running at room temperature. The 1GHz won't be available until at least the second quarter of 2000.	"Running Alpha at 1GHz frequency with no strings attached... demonstrates our advanced VLSI process," says KP Suh, Samsung general manager for CPU business.	Bring it on. Now if we could just get one this millennium, we'd be set.
Creative Labs Breaks Voodoo Texture Limit	Creative Labs irked partner-turned-competitor 3dfx by releasing yet another driver tweak that gives Voodoo-based Banshee and Voodoo^2 cards large-texture support.	Running Creative's MiniGL drivers gives Voodoo^2 and Banshee the ability to use textures larger than the card's limited 256x256 size.	"What we're trying to do is avoid getting the end-users caught up in the mess," says Jim Carlton, a senior brand manager at Creative Labs.	Kudos to Creative Labs for taking on a thorny issue and offering extra features and support where none were available.

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3Com, and Intel. To me it doesn't make sense. We don't want to compete with Intel," says Michael Howse of 3dfx. "And if the Rio is successful as a long-term business division for [Diamond/S3], then they're competing with companies even bigger than Intel—Sony, Panasonic, and Matsushita. I don't see how that's a successful business model."

"This is nothing but bad for us, the consumer."
—Maximum PC Reader

The big question for the remaining independent chipmakers, such as nVidia and Permedia, is whether there's a future at all. If 3dfx, S3, Diamond, and STB all decide that it's safer to build both cards and chips, what chance do independent shops stand? Could nVidia be dust by this time next year?

No way, says nVidia's Michael Hara. "If [building boards and chips as the only answer] was true, nVidia would have been out of business a long time ago, but we're number two in products shipped," he says.

Creative's Mosher also disagrees, stating that it's companies like nVidia and the former 3dfx that pushed forward innovation in 3D accelerators.

"A chip company can move and be nimble and introduce new products every six months and not worry about board inventory," Mosher says. "They'll never have a second thought about introducing the next chip that will kill their last product." This differs from companies that produce both chips and boards and have to worry about selling inventories before they launch awesome new products.

Still, industry observers wonder whether S3 had other motives for purchasing Diamond, an immensely popular brand with shoppers. Dean McCaron, a primary analyst with Mercury Research, says it's possible that S3 has a kick-ass product in the chute and wants an easy way to get it on store shelves. He also says that dwindling graphics card choices may actually mean a boon for buyers: The streamlined companies will no longer need to deal with middlemen and can deliver products faster and cheaper. Still, those who've already purchased cards that will be cut off by mergers might get screwed in the end. Of course, S3 and Diamond have pledged to avoid any disruption of support for their customers. But no one can really predict what will happen as the months pass and the competition heats up—and those with Diamond's Kick Ass Viper 770 Ultra have to wonder where their drivers will come from 12 months from now.

A gut-wrenching example of a merger that left a sour taste in consumers' mouths is the sordid tale of Canopus: When 3dfx decided to go solo, Canopus lost virtually all support from 3dfx for its highly acclaimed Pure 3D II Voodoo² cards.

"We can't sell 3dfx boards, and we can't buy [3dfx] chips, but we still have to support our existing products," says Canopus President Hiro Yamata. Yamata says the post-merger support from 3dfx is so bad, it took almost a year for Canopus to ship new drivers.

With S3 in the driver's seat of Diamond's massive retail marketing machine, some even fear a little skullduggery. Hara, of nVidia, says it's not unreasonable to suspect that the S3-controlled Diamond may sell the Monster and Viper lines in the fall, albeit with S3 chipsets powering them.

"The consumer has to pay a little more attention this fall to see who's carrying what," Hara says.

S3 and Diamond dismiss such fears as cat fighting. As far as they're concerned, what people should be concerned about is whether products from S3 and Diamond still rock. Diamond's Scott Vouri promises that they will.

"We plan to continue Diamond's dominance in the graphics market with the consumers in the gamer market and the others in the OEMs," Vouri says. "We will take on nVidia and 3dfx on the high end, and we'll take that from them." ●

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Pre-merger choices

3dfx Voodoo-technology cards

- Metabyte Wicked3D Vengeance
- Metabyte Wicked3D Voodoo²
- Quantum 3D Obsidian2
- Quantum 3D Raven
- Canopus Pure 3D II
- Canopus Pure 3D IILX
- Diamond Multimedia Monster 3DII
- Diamond Multimedia Monster Fusion
- Creative Labs 3D Blaster Voodoo²
- Creative Labs 3D Blaster Banshee
- Guillemot Gamer 3D2
- Guillemot Maxi Gamer Phoenix
- Jazz Renegade 3D
- Microconversions Game Wizard
- Miro Hiscore DII
- Techworks Power 3D II
- Elsa Victory 2
- Gigabyte GA-630

Post-merger choices, 3dfx/Voodoo

- 3dfx Voodoo³ 2000
- 3dfx Voodoo³ 3000
- 3dfx Voodoo³ 3500

to the pertinent details.

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HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Be Picks Up Steam, Gets Quake III	The niche OS called Be is picking up steam with OEMs, and winning popular game support.	AST, iDot.Com, and Microworkz will incorporate the alternative OS in new PCs this year, and pick up *Quake III*, *SimCity 3000*, and *Civilization*.	"One problems with being one of the small PC companies is the OS. [The OS manufacturers] won't even talk to you," said Mark Marlow, iDot VP of Product Marketing.	Jean, what took so long? Be has needed game support since its inception. Now let's see the frame rate reports.
Users Protest BIOS Ads	A hue and cry has risen over prospects that Phoenix Technologies may begin allowing companies to advertise on the BIOS boot-up screen.	An Internet petition has been formed among those who enjoy building their own PCs opposing Phoenix's plans.	"The fact is, someone out there is just wanting to make a buck," reads the Phoenix BIOS Petition Page.	Now that the BIOS will contain an ad, we suggest other uncharted territories: the keyboard, mouse, and banner ads in your source code.

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Rewritable DVD Spec Inches Forward

New DVD +RW spec unveiled, drives expected soon

If you're still waiting to burn gigabytes of data to DVD, you'll have to wait a little longer.

A new DVD rewritable spec, introduced at PC Expo, will likely make plans for good storage luvin' an unsafe bet for at least another year.

After a year of secrecy, DVD +RW backers showed off a boatload of recordable DVD drives, heralding them as the future of high-capacity storage.

DVD +RW backers say their technology offers several advantages over the competition: It's bigger, it's faster, and it doesn't need a cartridge.

The next-gen 4.7GB iteration of DVD +RW will also boast the ability to write DVDs that can be played on any consumer DVD deck. Eventually, DVD +RW owners should be able to capture digital video to their PCs, compress and edit movies, and burn a DVD that can be shared with friends. The consumer DVD deck compatibility alone seems to make the format destined for success.

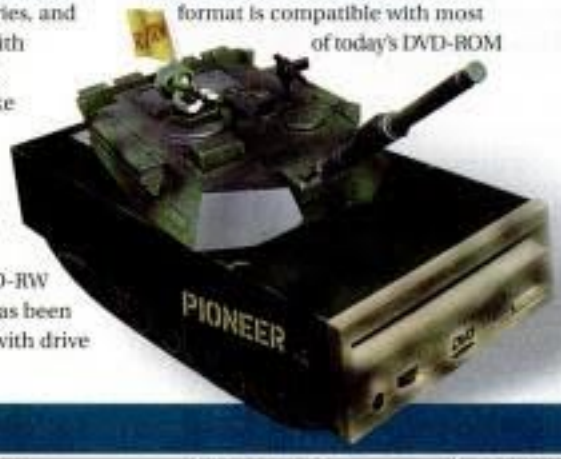
But the competition doesn't agree. While DVD +RW backers have been fumbling around for a year—some say to intentionally prolong revenue streams from CD-RW drives and patents—DVD-RAM has been on the shelves for almost a year, with drive prices already within reasonable ranges.

THE CONTENDERS

	DVD+RW	DVD-RAM	DVD-R/RW
Current capacity per side	3.0GB (rewritable)	2.6GB (rewritable)	3.95GB (write once)
Future capacity per side	4.7GB (rewritable)	4.7GB (rewritable)	4.7GB (rewritable)
Performance	CAV or CLV	ZCLV	CLV
Media	Bare disc	Requires cartridge (except for single-sided type-2 cartridge)	Bare disc
Rewritability type	Randomly rewritable	Randomly rewritable	Disc-at-once
Backers	Sony, Philips, HP	Panasonic, Hitachi, and Toshiba	Pioneer

Panasonic's DVD-RAM drive, which can write 2.7GB of data per disc side, runs about $525 on the street. With their early lead-time, DVD-RAM makers are also set to introduce second-gen drives by this fall. While no large OEMs have made DVD-RAM drives standard, the drives have proven popular with companies and people who need mass optical storage.

Despite their advantages, neither format is compatible with most of today's DVD-ROM drives. Instead of rewritable drive makers bending formats to fit everyone's needs, new DVD-ROMs will add compatibility, and those with older DVD-ROM drives will be out of luck. OSTA, the Optical Standards Technology Association, has already made its intentions clear: make every DVD-ROM manufacturer build future drives that support *all* standards. But so far, adoption of this policy is on the slow side. The only format to support current DVD-ROM drives is Pioneer's darkhorse DVD-R/RW spec; but DVD-R/RW will probably never reach your average PC. The drives cost over $5,000 and are good for only 1,000 burns before the lasers must be replaced.



A final hurdle will be the lack of compatibility between the competing standards. Will DVD-RAM support DVD +RW and vice versa? It's doubtful it'll happen, until people embrace one standard over the other. ●

SPIN CYCLE

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HEADLINE	NEWS	DETAILS	QUOTE	OUR TAKE
Kingpin Maker Defends Game	In light of the murders in Littleton, CO, the creators of the violent game Kingpin have inserted into the game's installation process a treatise on violence and video games.	The blame game has put developers from Texas to New York on defense.	"As soon as we... abdicate our personal responsibility toward caring for our children, we give up our basic freedoms as Americans," writes Kingpin developer Drew Markham.	Hear, hear. Video games don't kill people, people kill people.
Apple Sues iMac "lookalike"	Apple Computer isn't flattered that a Korean PC company has built a PC that closely resembles the popular iMac.	Apple filed a suit in federal court to stop Future Power from making and selling its ePower computer.	"We've invested a lot of money... to create and market our award-winning designs, and we intend to... protect them under the law," says Apple CEO Steve Jobs.	Sure Steve, now what about that Xerox PARC thing?

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M-1	Monitor	17.0"	16.0"
L-1	Monitor	19.0"	18.0"
XL-2	Monitor	21.0"	19.7"

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WATCHDOG

This month:

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- ▶ CDW's Non-Port Replicator
- ▶ Phone Cramming Alert

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NOT-SO-TRUE-X

When it was introduced last September, the True-X drive manufactured by Kenwood and sold by Hi-Val easily claimed the label "fastest CD-ROM on the planet." The drive, which uses multi-beam "True-X" technology to read a disc and was available in 40x and 52x speeds, racked up an impressive array of magazine awards, including one from Maximum PC. It also racked up an impressive number of complaints.

Here's two typical examples sent to the Dog:

"After only two months, the drive struggled to read any CD inserted into it, it vibrated incessantly, and data read from the 40x40 and burned onto the CD-R was often unusable. Half the time, Windows would recognize the drive but the drive would not spin up. Or, in the middle of a burn session, it would flat out quit."

"I bought the 40x40—I'm on my second one. The first drive I got made it about three months, with enough vibrations to shake the floor (no joking there) before it died."

Since the True-X went on sale, complaints like these have dribbled in to the Dog. When we heard about drives that died after a few weeks, or drives that had reliability problems, the Dog hooked consumers up with Hi-Val to get replacement drives.

But in April, the Kenwood/Hi-Val issue hit critical mass and the dribble of horror stories turned into a flash flood. At that time, Hi-Val terminated its relationship with Kenwood and stopped selling the True-X.

Tensions between the two companies quickly became apparent to customers—and the letters sent to the Dog detailed worse stories. One reader, Veronica Morales, called Hi-Val for help with her 52x drive and was told by an anonymous tech to "send me the drive and I'll throw it out." Morales said she got the bum's rush and was eventually directed to Kenwood for help. Though frustrated that Hi-Val refused to support the product she'd purchased from them just months earlier, Morales followed the instructions and sought support from Kenwood—and was shot down again. Eventually, she was told that the drive "simply has problems" reading CD-Rs. She (rightfully replied):

"My rinky dinky $40 unknown CD-ROM drive that I bought two-and-a-half years ago reads all my recorded CDs with no problems. Coming from an expensive CD-ROM drive, this is unacceptable."

Kenwood True-X

Other readers told the Dog that a three-month run of the True-X—those sold from June to August of 1999—was defective, and that a recall was in the works. Hi-Val officials corroborated this story, telling the Dog that they, too, suspected that a batch of drives was smelly.

What the heck is going on here?

According to Kenwood's Vice President of Marketing, Bob Selzler, it's all bunk. "We're finding that a great deal of misinformation has spread about a recall and about a defective batch of drives," Selzler told the Dog. "Due to this misinformation, we're actually receiving returned drives that have no problems at all."

Selzler also denied rumors that Hi-Val terminated its deal with Kenwood because too many drives were returned, claiming instead that Kenwood took over sales and support from Hi-Val because it made more branding sense.

"I bought the 40x40—I'm on my second one. The first drive I got made it about three months, with enough vibrations to shake the floor (no joking there) before it died."

Kenwood's take on the large number of complaints that readers brought to Maximum PC's attention—between 30 and 60—is that most are casualties of the transition from Hi-Val to Kenwood. Selzler also sees as a factor the technical expertise of those who bought the drives.

"The [technically savvy] demand the highest performance; they also tend to be some of the most vocal people out there. Is this reflective of the drive? Unfortunately, we're under a magnifying glass by some of these users and reviewers," he said.

Asked directly whether Kenwood has had an unusually high number of drives returned, Selzler responded: "We've had no higher than an average return rate on drives."

And what about those who say they got several bad drives?

Selzler pointed to configuration problems that he believes could have been rectified with the proper support. He also pointed to the possibility that repeated problems were just a fluke.

"We really apologize for any of the inconvenience caused to the customer. We stand behind our one-year warranty. If they're having a problem, let us hear about it, don't stew about it."

ILLUSTRATION BY SCOTT LAUMANN

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To reach Kenwood's tech support, e-mail support@kenwoodtech.com or call 888.730.4206.

Hi-Val, on the other hand, has remained mostly mum on the subject. Still in ongoing discussions with Kenwood about the problems, Hi-Val officials declined to comment at press time, other than to state that they also stand behind their warranty.

Sony's 711/CH

"We're not going to be able to make them 100 percent happy, but we'll do what we can do keep them satisfied," said Charles Parks, tech support manager at Hi-Val, of currently disgruntled customers. Parks said Hi-Val will replace defective 40x True-X drives or substitute a standard 50X CAV drive. To contact Hi-Val's tech support, e-mail techmanager@hival.com.

In spite of both companies' stated intentions to address customers' problems, some of our steamed readers may still consider taking action before a court.

"A class action suit is appropriate when there is a wide-spread manufacturing defect," Philadelphia Attorney Jonathan Shub told The Dog. "[The suit] depends on what they knew and when they knew it."

Is your Kenwood/Hi-Val drive a high-flying True-X or a low-level Turd-X? The Dog wants to know. Send your comments to watchdog@maximumpc.com with the subject: True-X.

MAN BITES CDW

"All I ask is that CDW allow me to return the part for credit because I feel they misrepresented their product."

DEAR DOG In March, I ordered a port replicator from CDW for a Compaq Presario 1236 notebook. CDW's web site listed the following part description: "Compaq Presario Port Replicator, for the Presario 1200 and 1600 Series notebooks." According to my research, CDW was the only company offering a port replicator for the Presario 1200 series, even though Compaq itself didn't indicate that the part was available. Concerned I'd order the incorrect part, I called a salesperson directly and asked whether the part I found on their web site was the one I should order for a Presario 1236. CDW's salesperson assured me that this part would work just fine, so I ordered it.

It was clear when I opened the package that the port replicator would not work with the 1236 series notebook. I called CDW to obtain a Return Merchandise Authorization (RMA). But I was denied an RMA number and told to contact Compaq directly for approval to return the part.

Compaq issued me a case number they claimed would satisfy the approval requirements CDW needed to issue an RMA. I called CDW back numerous times with the case number and other details, but my calls are never returned.

All I ask is that CDW allow me to return the part for credit on my Visa account, because I feel they misrepresented their product to me.

—Lonnie Howard

THE DOG RESPONDS Holy hot tamale! Although CDW has been a class act and receives an "excellent" status from www.resellerratings.com, nobody should have to go through such a runaround just to get a product refund. Before we called CDW on Howard's behalf, we checked with Compaq to see if a port replicator exists for the 1236 series notebook. Guess what? It doesn't. Compaq told The Dog that the port replicator advertised on CDW's web site would work only with model 1270, not with the entire 1200 series.

We then called CDW's sales line to see if they would blindly recommend the port replicator, even for the 1236 model. The sales person emphatically told us "Yes, it will work on the entire 1200 series, including the 1236." Doh!

Shortly after that, **THE DOG** contacted CDW to discuss this blatant misrepresentation. After politely explaining the situation, we asked CDW to do two very simple things: (1) modify its web page to let prospective buyers know which models the port replicator will work with; and (2) issue an RMA and credit refund to Howard immediately.

Two days after we sent our e-mail, CDW apologized for the runaround and informed The Dog that it had complied with both requests. The folks at CDW get a rawhide treat for their prompt resolution of this matter. Case closed. Woof. ●

Got a bone to pick with a vendor? Been spiked by a fly-by-night operation? Sic the dog on them by writing **watchdog@maximumpc.com**. The dog promises to get to as many as possible, but only has four paws to work with.

BEWARE OF DOG ▶

CANINE CAVEATS

DON'T CALL ME

Check your phone bills closely. The FTC and several consumer groups are warning that unscrupulous companies are adding such things as "web page building" to customers' phone bills even though they've never asked for the service.

In one scam, the Federal Trade Commission filed a lawsuit preventing an overseas firm from collecting on unscrupulous calls. The FTC says the firm sent blanket e-mail to unsuspecting individuals, claiming they would be billed several hundred dollars for services if they didn't call a number to cancel. When the consumers dialed the number, 767.445.1775, they were put on hold or sent through the voice mail tree from hell. Eventually, most people hung up. Unfortunately, the number they had dialed turned out to be located in the Caribbean island of Dominica, and the call cost them several dollars per minute. Although the FTC successfully blocked payments to the phone carrier in Dominica for that number, don't expect the scam to stop there—other scamsters will undoubtedly use variations of the trick to get their grubby paws on your hard-earned money. If you get a page on your beeper or a mysterious message that asks you to call an unfamiliar area code, dial 0 first and ask your operator if that number is in your country of residence. ●

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Danmere; www.danmere.com; $89 external, $69 internal; +44.1606.74330

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Plantronics; www.plantronics.com; $80; 800.544.4660

Magnet speakers + circumaural cones = maximum bass.

Plantronics' telescoping boom perfectly positions the mic.

Mindscape Organic Art Deluxe

Screensavers have come a long way since the days of flying toasters. The latest RGB orgy to shimmy across screens is *Organic Art Deluxe*, which taps into your Direct3D hardware and cranks out surreal landscapes and hypnotic 3D animations based on the art of William Latham. These aren't lame, flat-shaded polygons either—we're talking detailed, full-texture-mapped creations with souped-up effects such as environment-mapped reflections, motion-blurred animations, realtime shadows, and polygon deformation and stretching. *Organic Art Deluxe*'s stock sensebenders are pretty striking, but the coolest thing about this screensaver is the ability to combine the 87 meshes, 140 multicolored textures, and 75 backdrops in ways that bring your personal acid fantasies to life. It even includes ambient music, so you don't have to wear out all of your Dead bootlegs.
Mindscape; www.mindscape.com; $19.95; 800.973.5111

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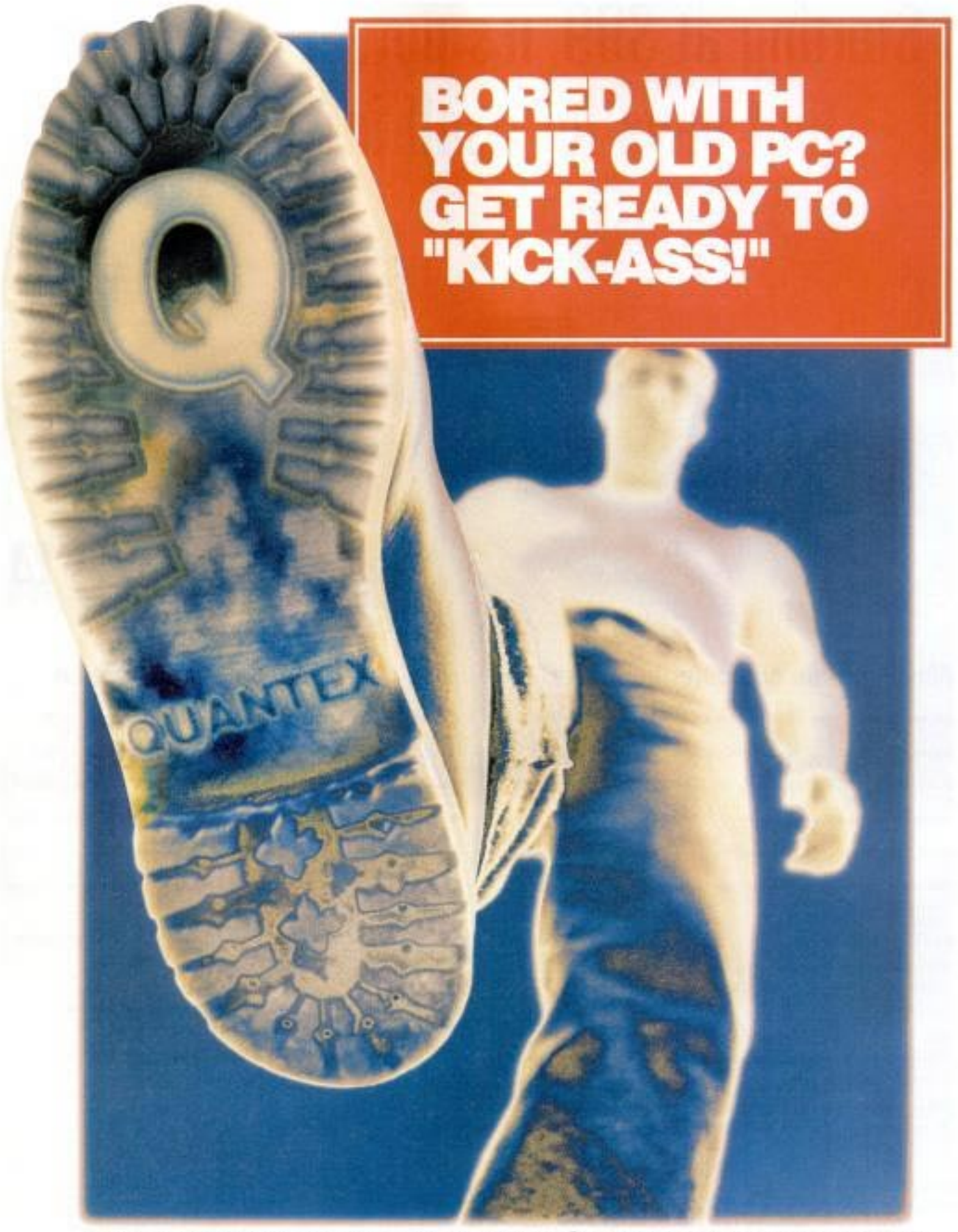

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intel inside
pentium III

QP6/550 GX-2 Model Shown

* Based on a July 99 Maximum PC Review. "Kick-Ass" awarded to QX550.

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Intel Inside, Cyrix Outside

THE TROUBLES OF A THIRD-RUNG CHIP VENDOR COULD HURT EVERYONE... EXCEPT INTEL

Cayenne, Gobi, Jalapeno, Jedi, Mojave, MXi, M3... Over the past year, Cyrix has shipped more code names than new processors. Intel's soaring clock speeds, combined with tumbling PC prices, spelled doom for poor little Cyrix. Only two years after National Semiconductor paid $550 million for the third-place CPU maker, the unlucky company is being sold off to a Taiwanese conglomerate—reportedly for one-third that amount.

The bottom-line explanation, of course, is the bottom line: Cyrix lost money—lots of it. The worldwide market for PC processors is worth $20 billion, but the chances of Cyrix capturing a profitable portion of that market were looking pretty bleak. So National decided to bail out and sell Cyrix to VIA, a core-logic chipmaker that belongs to a motherboard and memory-chip conglomerate.

What went wrong with Cyrix? And why should you care?

Answering the latter question first, Cyrix's misfortune matters even if you'd never buy a Cyrix-based PC. Unless VIA picks up the flag and keeps Cyrix alive, there will be less competition for x86 processors, and that *usually* leads to higher prices and slower progress in the long run.

If it weren't for competition from Cyrix and AMD, Intel probably wouldn't have slashed prices so drastically over the past two years. Intel was perfectly happy to see the average selling price of a PC hover around $2,000. In 1996, when Compaq chose the Cyrix MediaGX for its $899 Presario, it lit a fire under Intel, igniting a price war that continues to this day. Even if you paid $2,000 or more for your latest PC, you got more for your money because of feisty alternatives such as Cyrix and AMD.

Not that I'm blaming all of Cyrix's troubles on Intel. The market leader responded to the threat exactly as it should have—by shipping better, faster CPUs at lower prices.

All this would seem to leave AMD in a plum position. While VIA struggles to turn Cyrix around, AMD should pick up some extra business—but Intel is just as likely to pick it up, too. The folks at AMD probably aren't popping champagne corks right now. It could be that both AMD and Cyrix are on the Titanic, but Cyrix is closer to the bow.

One of the saddest ironies is that Cyrix has been developing some truly interesting products. Gobi, the code name for an improved M II, is expected to have faster MMX performance, a more powerful FPU, 3DNow! extensions, a 256K on-chip Level2 cache (twice as large as Celeron's), a 133MHz system bus (twice as fast as Celeron's), and a pin-compatible Socket 370 package (so it could work on the same motherboards as the latest socket-based Celerons). Gobi was supposed to debut this fall. And in mid-2000, Cyrix's next-generation Jalapeno core was scheduled to debut in a processor known as Mojave. But it's doubtful that Cyrix's new owners will be able to stick to that schedule.

TOM HALFHILL
was senior editor at Byte magazine and is regarded as one of the most knowledgeable experts on processor technology in the industry.Contact him at thalfhill@maximumpc.com.

There's always a chance that Cyrix's troubles will help some of the newer x86 competitors. Unfortunately, the newcomers have woes of their own. Centaur just shut down their WinChip operations, although the next-gen superpipelined WinChip could have turned things around...if Centaur had ever shipped it. Rise Technology is another promising upstart. But Rise's mP6 and mP6 II are relatively expensive to manufacture, and it's difficult for such a small company to establish a partnership with the big-name PC vendors whose massive volumes can really make a difference. Transmeta is still laboring over its rumored x86-compatible CPU, but has little to show for its efforts thus far.

The folks at AMD probably aren't popping champagne corks right now. It could be that both AMD and Cyrix are on the Titanic, but Cyrix is closer to the bow.

Although Andy Grove has retired as Intel's CEO, his "only the paranoid survive" philosophy still permeates the company. Even if Cyrix and AMD were hoping Intel would leave room for them at the low end, Intel doesn't surrender market share gladly and responded aggressively with the Celeron.

Cyrix and AMD were forced to match Intel's price cuts by sacrificing profits. That's bad enough, but they've also had trouble keeping up with Intel's clock speeds. While megahertz isn't the only way to measure system performance, it's the only way many people know. With AMD's 600MHz Athlon (K7) about to appear, Cyrix was a distant third and losing ground.

National Semiconductor isn't retreating from the CPU business entirely, as some reports have implied. It's just retreating from the kick-me-in-the-butt business. National still believes there's a big future in personal computing devices that aren't conventional PCs—everything from digital TV set-top boxes to hand-held WebPADs. Even after National sells Cyrix, work will continue on the system-on-a-chip technology that Cyrix began. National's upcoming Gilad chip is based on the MediaGX core. Thus, Cyrix's technology will live on for years, even if the company dies.

So, it looks like AMD has the best shot at seriously challenging Intel. I'd say the Athlon is a bet-the-company gamble. If AMD screws it up, "Intel Inside" might become as redundant as "Chip Inside." Intel is fortunate to have such unfortunate competitors. ●

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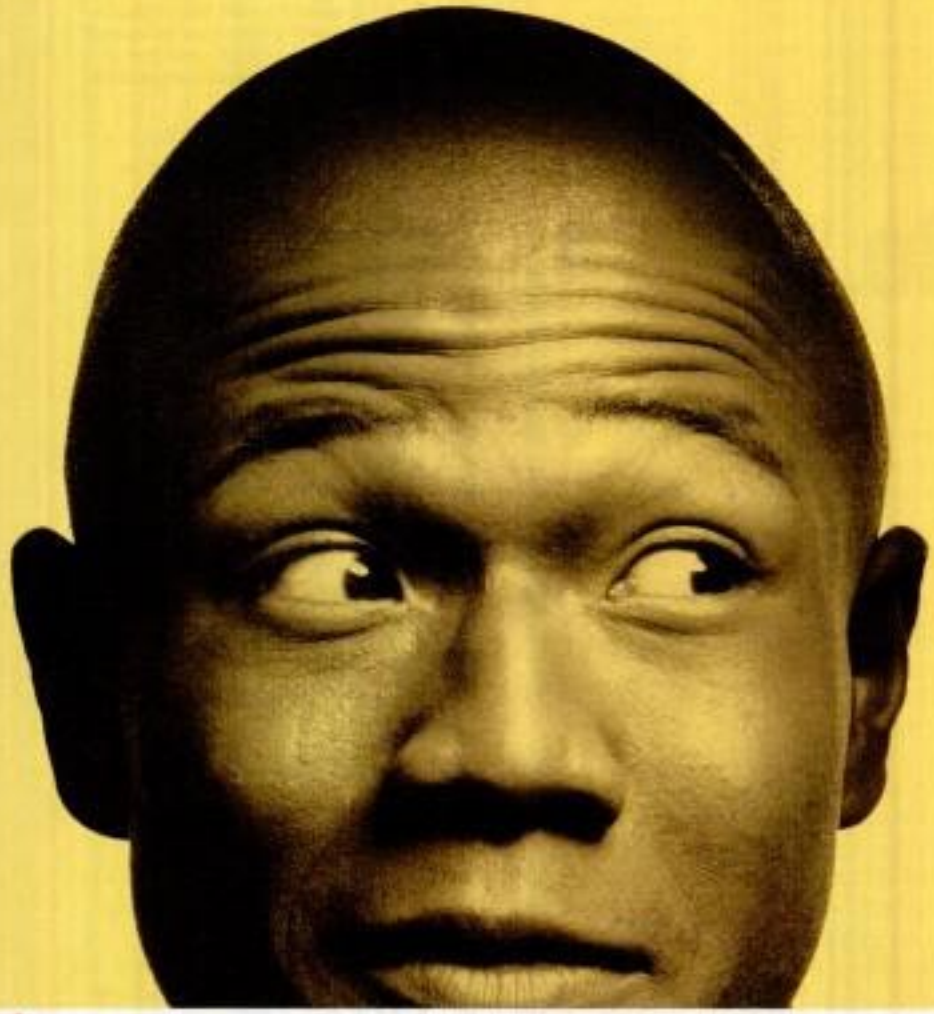

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AN AWARD-WINNING WEB DESIGNER REVEALS THE SECRETS OF HIS SUCCESS

Who'd guess a former indie-rock guitarist would walk away with the most prestigious award in advertising for his motion graphic work on the web?

Enter Hillman Curtis, principal of **hillmancurtis.com**, and arguably one of the top commercial designers in the world. His client list includes Intel, 3Com, WebTV, MTV, Lycos, Macromedia, and Capitol Records, and his trophy shelf holds the Communication Arts Award of Excellence, South by Southwest "Best of Show" and "Best Use of Design" accolades, and billing on How Magazine's "Top Ten," in addition to this year's One Show Gold.

Prior to piping into the computer world, Hillman fronted a mod band in "tight suits, a la Rickenbachers... jumping up and down, unplugging our guitars in the process..." After achieving some success with another band (and a song sold to *Beverly Hills 90210*, whoa!), Hillman applied the money toward an old Mac II and a couple of *Photoshop* classes. He spent his first year "bluffing my way into *Photoshop* and *Director* gigs, learning as I went." He went on to publish CD-ROMs and spent two years as Art Director of Macromedia. For the past ten months, he's run **hillmancurtis.com**, specializing in motion graphics for the web.

Hillman primarily uses *Flash 4* these days, along with a bevy of other software tools that includes *MotoDV*, *Premiere*, *After Effects*, *Freehand 8*, and *Dreamweaver*. When asked how *Flash* improved from version 3, he listed user interface, MP3 audio compression, and an easier-to-use symbol library as the top advancements. He added, "*Flash 4* has way more programming capabilities. It uses 'if/then' arguments, properties, variables, and more. We can create editable text fields and non-anti-aliased ASCII-like text that allows us to generate real web pages totally in *Flash*, with small text and editable text field forms."

When I queried him about the program's biggest technical limitations, he replied, "What we do is not really that technical; our focus is on communicating through motion, so we aren't presently doing a lot of deep interaction. We're telling stories, pushing brands, and messaging for companies in ten-second bursts."

Regarding the design challenges of those ten-second bursts, Hillman added, "As with all web design, file size is crucial. Many *Flash* designers forget that the same limitations faced by static designers apply to them as well. It's very easy to justify big file sizes with *Flash* because you can have so much movement and sound... You can almost convince yourself that it's worth having your viewers wait for it—but it's not. No animation can justify a 30-second download. Also, working with CPU limitations is crucial for good design. Testing your moves on a variety of CPU speeds is always a good idea. The last thing you want is an animation that chunks across the screen. Finally, working with economy is a huge challenge. What we try to do is first identify the singular message that the spot has to convey, and then we maintain focus, trashing gratuitous animation and anything that doesn't directly support the message."

SHEL KIMEN
has worked in the industry, traveled the world, and covered the Internet for both The Net and boot magazine. She can be contacted at **skimen@maximumpc.com.**

Who are Hillman's heroes?

"I like the big guys... Neville Brody, Kyle Cooper, and David Carson. I also like some of Attik... love the work coming from Tomato. Saul Bass... this guy Klaus Mai... and Stephan Siegmiester."

And on the web?

"Josh Ulm's work for Remidi.com... Todd Purgason over at Juxt, and Matt Owens at **Volumnone.com**... of course Kyle Cooper is a huge influence. I like the **yuko.com** site, and **www.i2f.com**, a Japanese site."

Has your appetite for *Flash* been whet? Hillman's got a book on *Flash 4* coming out this fall, published by MacMillan/NewRiders. "The book is directed towards those who rely on intuition in learning, and not on manuals."

In the meantime, Hillman advises, "Macromedia has resources, and there are a number of great *Flash* user sites, such as **Flasher.com**. Other than that, I'd say go find a mentor, someone who knows the program, because it can be counter-intuitive at first. But once you get past the hurdles, it makes so much sense. So stick with it and focus on expression. *Flash* is just a software tool... ideas, design and creativity are what I focus on." ●

"It's very easy to justify big file sizes when you can have movement and sound... you can almost convince yourself that it's worth it. But no animation can justify a 30-second download."

—Hillman Curtis

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▶THE SCOOP FROM A MAJOR PLAYER

GAME THEORY

You Will Be Emulated

CONSOLE EMULATORS ARE NOT PIRACY; THEY'RE INGENUITY AT WORK

T. LIAM MCDONALD
is a veteran of PC Gamer magazine and is much bigger than he looks in this picture, so keep that in mind before writing him any hate mail at tmcdonald@maximumpc.com.

I keep hearing that emulation is going to kill the console game industry. That it's piracy. It infringes on the rights of console companies *and* console developers. It's responsible for a rise in juvenile crime, the hole in the ozone layer, and the entire Clinton Administration. It must be stopped, by swarms of lawyers and federal agents in body armor if necessary.

While I loathe piracy and have been lambasted for my columns denouncing warez and other Internet trading of registered software, it's clear to even me that emulators are not, in any way, shape, or form, piracy. If they were, Sony and Nintendo's attempts to block retail emulators such as *bleem!* and *VGS* from Connectix might have succeeded. Instead, the console companies are merely huffing and puffing and spewing outrageous claims because they've been trumped by kitchen-table programmers and publishers.

I love it when that happens.

For those not yet introduced to the ever-growing world of emulators, here are the basics: An emulator for the PC (which is our only concern in this space) is software that enables a PC to run games from other formats, such as PlayStation. *bleem!* is the leading program; it's currently sold for about $30, despite Sony's best efforts to bury it. Emulators offer varying degrees of performance, and generally require a high-end system with a 3D card in order to deliver good results.

Nintendo and Sony have very different reasons for being concerned about emulators. Nintendo's current problem is the distribution of ROMs, which are the data from N64 (or earlier) chips that contain the games. These ROMs can be freely distributed on the web and played on any PC with an emulator. Clearly, this is piracy. But since emulators can be pretty flaky, this actually presents just a slight problem—one that Nintendo has addressed with all the subtlety of a bazooka.

Their legally incorrect stance is that the distribution of all ROMs—and hence the use of all emulators—is piracy. First, anyone can *make* a ROM of their own without stealing any code, or can reverse-engineer out-of-print titles. Sure, old titles are still copyrighted, but if they are not on the market, a company can't claim any loss of revenue. As for the emulation programs, the major ones use no source code from Nintendo, Sony, or anyone else, and are therefore completely legal. (In earlier days, some emulators required BIOS dumps, which was in fact a violation of copyright.)

Sony is even more upset than Nintendo about emulation, and for even less reason. While some emulators may indeed allow gamers to use illegally copied CD-Rs and downloaded code, the most popular emulators prevent this. *bleem!* will not run any PlayStation program unless the original disk is in the drive. How does this hurt the developers, who now have an entirely new market (PC owners) to sell to? Not one iota. It's the best thing that could happen to publishers. Of course, it may cut into PlayStation *hardware* sales, but how serious is that? Everyone knows the profit is in the software, not the hardware. When Sony introduced the PlayStation, the machine was sold for close to cost in order to establish a user base for the true money train: the games. Thus their arguments for the damage emulators cause are hollow.

Nintendo's response (taken from its online FAQ) is typically hysterical:

"The only purpose of video-game emulators is to play illegally copied games from the Internet.... The introduction of video game emulators represents the greatest threat to date to the intellectual property rights of video-game developers. As is the case with any business or industry, when its products become available for free, the revenue stream supporting that industry is threatened. Such emulators have the potential to significantly damage a worldwide entertainment software industry which generates over $15 billion annually, and tens of thousands of jobs."

The statement that the only purpose of emulators is to "play illegally copied games from the Internet," is just a lie. Once you buy a game, you can play it wherever and whenever you want. It's yours. If you want to patch together a lawnmower, a Watchman, and a pair of ice tongs to play *Sonic Cruises for Hookers*, or anything else Sony is publishing, that's your right.

Emulators are, in fact, a terrific thing for the *true* gaming enthusiast. While the major companies are only too willing to consign older products to oblivion, hardcore game fans are busting their collective asses to keep them alive. Gaming, like any form of entertainment, has a heritage that is completely out of reach for today's consumers. A few issues ago, I lamented the industry's practice of making great games instantly disposable by rushing to the "next big thing." The early days of Atari, Commodore, Sega, Intellivision, Apple II, Jaguar, Lynx, and Colecovision are lost to current and future generations without emulation. N64 and PlayStation will one day suffer the same fate as NES and Sega Genesis.

If you want to patch together a lawnmower, a Watchman, and a pair of ice tongs to play Sonic Cruises for Hookers, that's your right.

The problem isn't the rise of emulators. It's that there are too few of them. ●

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TECHNOLOGY UPDATE

How to make your car invisible to radar and laser

Rocky Mountain Radar introduces a device guaranteed to make your car electronically "invisible" to speed traps—if you get a ticket while using the product, the manufacturer will pay your fine!

by Phil Jones

If your heart doesn't skip a beat when you drive past a speed trap—even if you aren't speeding—don't bother reading this. I can't tell you how many times that has happened to me. Driving down the interstate with my cruise control set at eight miles over the limit, I catch a glimpse of a police car parked on the side of the road. My heart skips a beat and for some reason I look at my speedometer. After I have passed the trap, my eyes stay glued to my rear view mirror, praying the police officer will pass me up for a "bigger fish."

■ ***The Phazer will "jam" both radar and laser guns, preventing police from measuring your speed.***

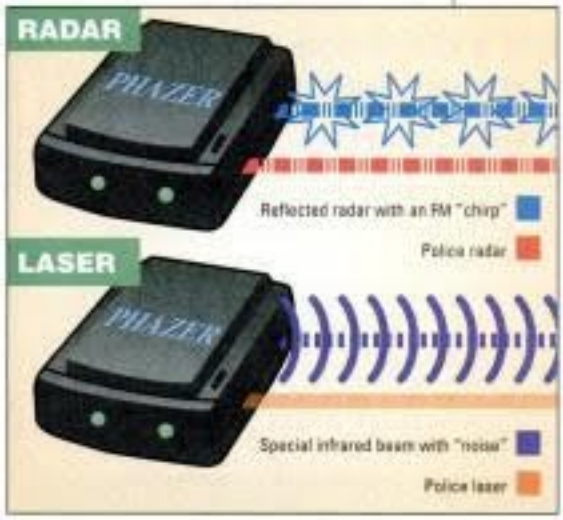
It seems that as speed-detection technology has gotten more and more advanced, speeding tickets have become virtually unavoidable. And although devices exist that enable motorists to detect these speed traps, they are outlawed in many states... including mine.

The solution. Today, Rocky Mountain Radar offers drivers like me a perfect solution—the Phazer. Combining a passive radar scrambler with an active laser scrambler, the Phazer makes your automobile electronically "invisible" to police speed-detecting equipment.

The radar component works by mixing an X, K or Ka radar signal with an FM "chirp" and bouncing it back at the squad car by way of a waveguide antenna, effectively confusing the computer inside the radar gun. The laser component transmits an infrared beam that has the same effect on laser Lidar units.

Shown actual size, the Phazer is only 3"W x 4"L x 1.5"H!

Perfectly legal. Some radar devices have been outlawed because they *transmit* scrambling radar beams back to the waiting law enforcement vehicle. The Phazer, however, *reflects* a portion of the signal plus an added FM signal back to the police car. This, in effect, gives the waiting radar unit an electronic "lobotomy." Best of all, unless you are a resident of California, Minnesota, Oklahoma, Virginia or Washington, D.C., using the Phazer is completely within your legal rights.



HOW TO MAKE YOUR CAR DISAPPEAR

Radar and laser scramblers are devices that foil speed traps by making vehicles electronically "invisible" to police radar. Radar scramblers mix a portion of the radar signal with background clutter and reflect it back to the squad car. This technique, pioneered by Rocky Mountain Radar, creates an unreadable signal that confuses the computer inside the radar gun.

The laser scrambler in the Phazer works in a similar manner. It transmits a special infrared beam with information designed to scramble the laser signal. The result? Readouts on police radar and laser guns remain blank. As far as the police officer is concerned, your vehicle is not even on the road.

■ ***The Phazer makes your car invisible to police radar and lasers or the manufacturer will pay your speeding ticket!***

How it scrambles radar. Police radar takes five to 10 measurements of a vehicle's speed in about one second. The Phazer sends one signal that tells the radar the car is going 15 m.p.h. and another signal that the car is going 312 m.p.h. Because police radar can't verify the speed, it displays no speed at all.

Works with laser, too! The Phazer also protects your vehicle from Lidar guns that use the change in distance over time to detect a vehicle's speed. The Phazer uses light-emitting diodes (LEDs) to fire invisible infrared pulses through the windshield. Laser guns interpret those pulses as a false indication of the car's distance, blocking measurement of your speed.

Range up to three miles. The Phazer begins to scramble both radar and laser signals as far as three miles away from the speed trap. Its range of effectiveness extends to almost 100 feet away from the police car, at which point you should be able to make visual contact and reduce your speed accordingly.

Encourage responsible driving. While the Phazer is designed to help you (and me) avoid speed traps, it is *not* intended to condone excessive speeding. For that reason, within the first year, the manufacturer will pay tickets where the speed limit was not exceeded by more than 30%, or 15 miles per hour, whichever is less.

Double protection from speed traps. If the Phazer sounds good, but you prefer to be *notified* when you are in range of a police radar, the Phantom is for you. The Phantom combines the Phazer (including the Ticket Rebate Program) with a radar detector. It's legal in every state except California, Minnesota, Oklahoma, Virginia and Washington, D.C. Ask your representative for more details!

Risk-free. Speed traps don't make my heart skip a beat anymore. The Phazer and Phantom are both backed by our risk-free trial and three-year manufacturer's warranty. Try them, and if you're not satisfied, return your purchase within 90 days for a "No Questions Asked" refund.

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TECHNOLOGY UPDATE

Stealth antenna hides under gutters but performs like big ugly antennas

The new Max Antenna by GE is the low-profile, high-gain way to get flawless reception of broadcast signals without expensive installation.

The Max Antenna by GE is the ultimate TV antenna system.

Electronic engineers agree—your television is only as good as the signal it receives. Unfortunately, antenna design has not kept pace with improvements in television quality and the features available. Both cable and satellite television systems have spent a great deal to improve the quality of their transmission, but they can be extremely expensive, they aren't available in all areas and may not provide access to local TV stations. The advent of digital broadcast television is about to change the face of television, and in the near future, broadcasters will begin transmission of these high definition signals. This will mean that you won't need to pay outrageous cable bills or subscribe to satellite programming to get the perfect picture.

So people have headed back up to the attic and pulled their old rabbit ears out of storage. What they'll find is that although rabbit ears will provide reception of over-the-air signals, they are just as ugly and just as difficult to adjust as ever. Luckily, there is a new antenna from GE that will provide breakthrough performance without making your family room look like something out of the fifties.

Fuzzy outlook. If you subscribe to cable, you receive a quality picture on most channels, as long as storms or other factors don't disrupt your service. Unfortunately, the interference caused by the signal bouncing off buildings and other large objects, known as multipathing, often results in "ghosting" or "snow." If you'd rather not pay a hefty monthly sum for the privilege of receiving a signal, your options have been limited, and your picture was likely to be distorted. You could always mount a huge antenna on your roof, but that's not even allowed in some neighborhoods. Then there's the problem of aiming the antenna at the broadcast source.

Clear alternative. The Max Antenna series from GE uses a revolutionary electromagnetic design to maximize installation flexibility and yield longer range reception of off-air VHF and UHF signals. Unlike a conventional dipole antenna, the Max Antenna can receive signals in both vertical and horizontal planes with minimum cross-polarization loss. This design allows for the first low-profile antenna solution that provides numerous installation options.

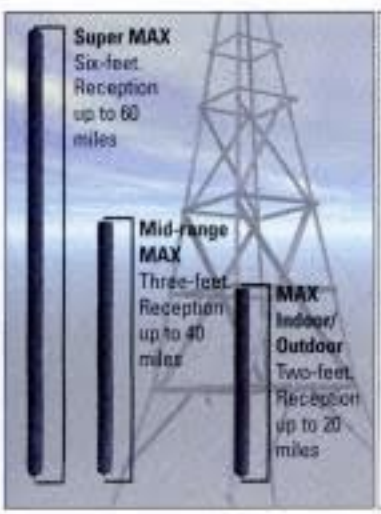
Superior components. The key to the superiority of this antenna is its ingenious use of the latest electromagnetic technology—providing high gain and full channel coverage as well as the greatest amount of mounting flexibility. First, the antennas were designed around a wide band element to achieve the greatest amount of gain in a relatively small space. Next, an amplifier and matching network was designed to enhance the reception of weak signals. This amplifier also adds very little distortion to the strong signals, giving it a balanced amount of gain. A filter on the amplifier board will allow for good matching between the antenna and amplifier. Special attention was paid to design an antenna-amplifier combination that would be completely compatible with the new digital transmission format. It has been designed for strong signal distortion rejection and a low amount of noise. The scientists who designed it followed certain optical principles to give the antennas good sensitivity in both the vertical and horizontal plane. It is omnidirectional and requires no adjustments, orienting or fine tuning during use. You simply install it, set it and forget it.

The best antenna you'll never see.

Would you rather have the "old-fashioned" unsightly antenna tower or get even better reception with one that you can mount horizontally or vertically.

Attractive design. This antenna has been designed with your living space in mind. It features a durable textured surface that mounts easily and can be painted to match any decor. You can mount it vertically on your chimney or horizontally under the eaves of your rooftop. If it weren't for the improved picture on your television, you would never know it was there.

Risk-free reception. The Max Antenna is the perfect way to get a perfect picture. It comes with Comtrad's exclusive risk-free home trial. If you are not completely satisfied, return it within 90 days for a full "No Questions Asked" refund.



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MP3'S BIGGEST THREAT

RECORDING INDUSTRY DEFENDER HILARY ROSEN RIFFS ON THE INTERNET AND WHY THE WAY YOU BUY MUSIC WILL NEVER BE THE SAME AGAIN

Maximum PC You've stated previously that digital music represents the "end of the world as we know it." How?

Rosen Right now consumers are—more than ever and more than probably anyone could have imagined—really driving the music market. And companies—big and small—will no longer dictate the form consumers will get their music in.

Maximum PC And this comes as a complete surprise to the music industry?

Rosen Well, no. As the Internet has evolved, all international businesses have woken up to a series of changes. It's actually been a kind of evolution.

Maximum PC Is this evolution exciting or is the industry paranoid about the imminent change?

Rosen Big companies with billions of dollars in assets and copyrights obviously look at this differently than the guy building his music company out of his mom's house. The throw-it-against-the-wall-and-see-what-sticks mindset has been pretty much a risk-free proposition for that kind of person. But to an artist selling 99% of his work through WalMart or Tower Records, screwing that up has been a significant concern.

Maximum PC In terms of digital music distribution, many credit the record industry's long-standing refusal to develop a standard with actually forcing the creation of MP3s. Do you agree?

Rosen No. I don't think anyone in the industry was trying to stop digital music distribution. I just don't think anybody was putting a lot of resources into creating it. Clearly, it was the music fans that drove this. They're the visionaries who decided which way this thing evolved. And I'm grateful they've done it. This is going to be a huge, new opportunity for the music industry and for the creative community to get more music out there, to have a wider diversity of music available, and to make more money.

Maximum PC How much did the advent of MP3s catch the industry by surprise?

Rosen We've been doing online enforcement for a long time, so it's not like MP3s caught us by surprise or anything. We've been talking about this for more than 10 years. The thing that really caught us by surprise was how much the mainstream media promoted this. They did a good job of advancing the hype of "isn't it cool to steal artists' music?," even if they call it "trading music with your friends" instead of stealing.

What caught us all by surprise was that this became the symbol of the Internet as some revolutionary force providing power to the people in this really sexy way and not just stealing artists' music, which is what we saw.

Maximum PC And you consider it "stealing?"

Rosen Because that's what it is. The thing that has consistently worried artists and record companies is people ripping songs from a

PROFILE

NAME
Hilary Rosen

RANK
President and Chief Executive Officer of the Recording Industry Association of America

MISSION
Defending the recording industry's interests; eliminating illegal MP3 websites; simultaneously working to create a legitimate model for distributing music online.

LAST KNOWN WHEREABOUTS
Washington, D.C.

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CD and posting them on a bulletin board. Those are the people we've gone after. We've never gone after the person who actually downloads it.

Maximum PC But isn't going after MP3 web sites a losing proposition? Shut one down and another takes its place almost immediately.

Rosen I'm not pulling a Chicken Little about this, and I don't think the sky is falling. It is manageable. We've been doing a credible job keeping it in perspective. We go after the worst offenders. We have a variety of search methods. And we've prioritized sites based on the amount or type of files they offer.

Maximum PC So, the RIAA has no plans to target individual collectors?

Rosen No, it doesn't seem practical. It's virtually impossible to do and it doesn't make any sense for us to try. Besides, I have very strong views about privacy, so I'm not going to start doing it.

Maximum PC Do you have any plans to shut down the newsgroups?

Rosen I'm never going to shut down a news site. I'm never going to shut down a chat room. That's speech. But we certainly monitor them to the extent that they direct people to FTPs and other web sites.

We might try to totally shut down an FTP site where there's nothing but music files, but in the newsgroups, we just ask them to take the music off.

Maximum PC Do you think people are prone to rip CDs because they're still so friggin' expensive and never came down in price as originally promised?

Rosen Oh, sure they have. CDs were originally around $21. Now they're anywhere from $11 to $14. But don't take my word for it. *USA Today* just did a study on the cost of entertainment and its inflation factor. Guess what? The cost of music went up the absolute lowest of any other form of entertainment, including software, movies, or even going to an amusement park. It's ironic that nobody ever talks about those prices. The cost of CDs has barely kept up, even with inflation.

Maximum PC So, you don't think CD's are overpriced at all?

Rosen No. I think they're fair. You get value for your dollar. It's a permanent thing. It's not a one-time viewing. You'll have it in your collection for 100 years.

There's a lot of mythology about the costs of the CD. The polycarbon is the least of it. Recording costs are very expensive. The biggest costs are the marketing and promotion and development of the artist. Frankly, the Internet has only made that more expensive, because it has created more places to buy ad space or promotion. Everybody thinks the Internet is going to make it cheaper to deliver CDs. It won't.

"BIG COMPANIES WITH BILLIONS OF DOLLARS IN ASSETS AND COPYRIGHTS OBVIOUSLY LOOK AT MP3S DIFFERENTLY THAN THE GUY BUILDING HIS MUSIC COMPANY OUT OF HIS MOM'S HOUSE."

Maximum PC Have music sales been impacted by MP3s?

Rosen We haven't experienced any lost sales, but sales have been impacted by the Internet—in a good way—because of all the online retail that's taken place.

Maximum PC So, will CDs disappear altogether anytime soon?

Rosen No. CDs still have the best quality music. It's better than MP3 and presumably better than any compression. It will be around at least for the next several years.

Plus, there's the general socialization of shopping. Movie theater attendance didn't go down when VCRs came out and bookstores are still a really fun place to go, even though you can sit at home and buy through Amazon.com. The social experience of buying music won't go away.

Finally, lots of artists still create concept albums. And having the album—and all the liner notes, artwork, and song lyrics—is a really important part of loving that artist.

Maximum PC But haven't MP3s demonstrated that consumers are more than OK with downloading singles rather than buying complete albums?

Rosen Which single would you pick from *Sgt. Pepper's*? Which would you pick from the *White Album*? Single sales will still be strong, but having an album means something entirely different. Artists will always create this way.

Maximum PC Overall, how have artists reacted to the MP3 controversy?

Rosen Most artists want to get paid for their work—I haven't met too many yet who don't. A lot of emerging artists want to use the Internet to get a foothold, but once they get to a certain point, guess what? They want to get paid for their work. And free music means they won't get rewarded. We've had tremendous artist unity on this point. Even my friend Chuck D adheres to this belief—he just doesn't want his money to go to a record company. Just because he believes in the free trading of music doesn't mean he doesn't want to get paid.

Other artists want to preserve more traditional models. I was on a panel recently with Duncan Shiek and somebody asked "Why don't you do what Ani DiFranco is doing and create your own company? What do you need Atlantic for?" And he said, "I couldn't do it. I don't think that way. I get distracted. I really like having somebody else, whether it's Atlantic or my mother or your sister, helping me get my music out there. I just want to worry about creating it."

Maximum PC You're friends with Chuck D, an outspoken proponent of MP3s? What's that friendship like?

Rosen Chuck is awesome. He's smart and he's a visionary and he is defiant. Chuck's problem is that he hates record companies and doesn't think he got a good deal. And he probably didn't. But I don't think he takes anything away from the need to be out there creating and controlling your work. If anything, he's more about being able to control his work than most people.

Maximum PC Have any big stars been launched on the Internet?

Rosen There haven't been yet, but that's only

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5% Of All PCs Are Ready for the Year 2000.

For the Rest, There's IntelliFIX 2000™

If you're reading this, you probably have a Y2K problem. That means on New Year's Day, 2000 your $3,000 computer simply won't work well — if it works at all. Imagine going to work on Monday Jan. 3, 2000 and finding out you're unable to do the things you've come to rely on, like check your e-mail, write a memo or browse the Web.

Well, don't dust off that typewriter just yet. There is a foolproof solution to your Y2K problems. It's IntelliFIX 2000.

IntelliFIX 2000 fixes your computer's Y2K software conflicts by looking at every line of application and operating system code, selecting each line that has a Y2K conflict, and making the code Y2K compliant. But that's not all. IntelliFIX 2000 also fixes all Y2K hardware conflicts in the BIOS and CMOS Real-Time Clock. . . guaranteed!

It's truly simple to use. Just pop in the IntelliFIX 2000 disk and watch it automatically find and fix your PC's millennium bugs.

Time is running out. Protect your PC and the valuable data stored in it with IntelliFIX 2000.

Add IntelliFIX 2000 to your New Years Eve party shopping list.

And, Have a Happy New Year!

Passes Key Labs rigorous testing.
Download your free test version of IntelliFIX 2000 to test your PC for Y2K compliance at: www.intelliquis.com/intellifix.html

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a matter of time. There will be. It's surprising that it hasn't happened yet. The Internet is going to be as good an Artists and Repertoire source as anyplace else. It will be used the same way record companies and managers troll the clubs and college radio stations.

People could use MP3s for lots of different reasons. That format will have a long-lasting impact on the online music space. It can be secure if the distributor wants it to be secure. It's also small enough to be easily storable and downloadable.

Maximum PC What do you think of MP3 sound quality?

Rosen A lot of people don't like the way MP3s sound. Even though everybody touts them as being as good as digital, they're still compressed.

Maximum PC Can anyone really discern the difference?

Rosen In an AB test they could; in an AA test, I don't know that they could. Listen to a CD on a good stereo system and it sounds great, but it won't be the same quality through computer speakers. Hell, people still bought cassette tapes even though they sounded shitty!

Maximum PC Can anything supplant MP3s?

Rosen No, I think they have a real stronghold with bands trying to promote themselves. But over the long-term that's not going to fly. You can always get Madonna's "Like a Virgin," but when you want Madonna's new album next year, it's not going to be in MP3 format. It's going to be in a format that's more compatible with SDMI-like features.

Maximum PC Is the RIAA developing an alternate technology?

Rosen No. There are enough people already out there developing technology. Several different formats are being experimented with but I don't think there's going to be a "winner," in terms of technology, for a long time. The key is that they all have some level of compatibility and accessibility. My ideal format would be something that moved quickly onto my hard drive from a site that had a huge selection of new releases. I'd certainly be willing to pay for that.

Maximum PC Which begs the most obvious question: Why would someone pay to download a song when they can get it for free via MP3?

Rosen Well, that will clearly be the challenge, won't it? First off, we're trying to make it harder to download free songs. We also acknowledge that CDs are going to have to have some value-adds: lyrics, packaging, or other information about the artist.

"WHAT CAUGHT US ALL BY SURPRISE WAS THAT MP3S BECAME THE SYMBOL OF THE INTERNET AS SOME REVOLUTIONARY FORCE PROVIDING POWER TO THE PEOPLE IN THIS REALLY SEXY WAY AND NOT JUST STEALING ARTISTS' MUSIC."

Maximum PC When you buy a CD, what are you granted in terms of the license?

Rosen Music CDs are similar to software. Basically you buy the rights to that unique product, not to the intellectual property embedded within it. The law gives you the right to make a single copy of it. But that's really the major issue for us. The major issue is taking that copy, putting it on a bulletin board, and making it available for thousands of people. This is less about what's legal and more about what's fair.

Maximum PC Will the Secure Digital Music Initiative (SDMI) be the ultimate solution?

Rosen SDMI isn't necessarily the be-all and end-all solution. It has to provide benefits for the consumers, the technology industry, and computer manufacturers. Major record companies are not going to be the biggest beneficiaries of SDMI because technology companies are going to the new record labels with their own deals. The big players going forward are finding each other. SDMI just levels the playing field to allow a lot of the smaller tech companies and the smaller online record labels to build products to a standard that is going to be consumer-compatible. If anything, it opens up the market.

Maximum PC Why did the RIAA choose to attack Diamond's Rio MP3 player?

Rosen When the Rio was announced, virtually everything downloaded was unauthorized. Diamond, like any good entrepreneurial company, was clearly trying to get a jump into this space. But we felt they were doing it to take advantage of the unauthorized market.

Their statements—that they only supported authorized files—didn't ring true, since authorized sites didn't even allow access. At the time we felt we had to do two things: find a way to encourage technology companies to think about the long-term big picture, and get them to think about combining the words "security" and "Internet" in the same sentence.

And, on behalf of the creative community, we were trying to draw the line in the sand about right and wrong. How did we feel about online piracy and were we going to make a statement? The Audio Home Recording Act wasn't specifically designed to deal with moving data from a hard drive to a portable device, but it seemed the cleanest way to go, rather than the alternative: a straight contributory infringement case.

Maximum PC Where does the lawsuit go from here?

Rosen When we lost the last appeal, both Diamond and the RIAA made statements that this lawsuit was already sort of old news. New partnerships have been developed, and a new dialogue created. I know it pissed a lot of people off, but in the end, getting together industries that weren't talking to each other had some benefits.

Maximum PC Does it bother you that the Diamond lawsuit may have propelled MP3s into the mainstream, increasing the sales of the Rio and the ubiquity of MP3s overall?

Rosen That's a fair question... and we'll never know the answer. People seemed to like the MP3 phenomenon more because it pissed the record companies off. But Diamond was riding a wave that was already building, so it would have happened regardless of whether we had sued them or not. ●

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EarthLink It's YOUR Internet

DREAM
MACHINE 99

BUILD IT.

Our complete guide to building the perfect PC in 16 easy steps.

Only you are intimately familiar with the PC of your dreams—a lean, mean, megahertz-thumping machine packed with the precise kick-ass components you've been lusting after. You want the best, and you want it made-to-order.

For some, a Dream Machine isn't complete without a broadband Internet hookup and state-of-the-art 3D card. Others demand a fat hard drive they can fill to the gills with MP3s. Still others are looking for an unassuming little box that simply fits on the desk.

It's your Dream Machine, bub. Make it what you will.

You guessed it. It's zero hour. It's time to cut the crap and construct your own killer box. No system vendor will sell you a PC built and optimized to your special requirements—the only way you'll ever see such a machine is if you build it yourself.

And that's where we insert our grime-covered noses.

We've blueprinted and hand-built a Dream Machine every year since 1996, and every year we've put the spotlight on the parts that comprise it. But while we've always shared the nuances of our hardware choices right down to voltage requirements, we've never actually shown you how to build yourself a Dream Machine. So this year, we're expanding our annual Dream Machine feature into a comprehensive guide to building a PC that you can drop right into your personal fantasy file.

Starting with a list of all the parts you'll need, we walk you through a step-by-step PC construction guide. Our crack team of experts leaves no screw out of place and no IRQ unresolved. Eager to get shopping? We've also put together a buyer's guide that provides insight on selecting the perfect PC parts. We top off the package with our component choices for Extreme Machine 99—the savage PC-cum-andro-beast we'd build if price were no object.

Don't wimp out on us, readers: Build your own Dream Machine, benchmark it, and tell us all about it in a quick e-mail to dream-machine@maximumpcmag.com.

If you don't explore the frontiers of Pure PC Power, who will?

PHOTOGRAPHY BY K. HUTCHESON

Buy It.

THE DREAM COMPONENTS Here's a list of the component categories you'll need to fill. While our parts for Dream Machine 99 don't represent the zenith of pure PC power, they're generally kick-ass, and combine to form an elegant, well-integrated, feature-packed machine. In order of appearance:

▶ Case: PC Power & Cooling Personal AT/ATX Mid-Tower Enclosure
This baby offers easy rear accessibility, removable side panels, three 5.25-inch and two 3.5-inch drive bays, and an additional 3.5-inch removable storage bay. Plus, it's sturdy as hell. We got one packed with a 275W Ultra-Quiet Silencer power supply, to cut down on noise. $65 (power supply upgrade costs an additional $99); **www.pcpowercooling.com**

▶ Motherboard: Abit BX-6 R2
In a world of blah Intel Seattle mobos, Abit's BX-6 is remarkably tweakable. The latest (and possibly last) BX-chipset board from Abit uses soft jumpers in the BIOS, which will keep you from crawling among the dust bunnies in search of that tiny plastic jumper that leapt to the floor. The R2's external temperature sensor, five PCI slots, and user-configurable voltage settings are just icing on the cake. $125; **www.abit.com.tw**

▶ CPU: Pentium III 500MHz
When collecting parts for the Dream Machine, Athlon wasn't even available. The Pentium III 550MHz was, but we decided to take advantage of Intel's wacky pricing schemes and went with a 500MHz, which at press time was about $250 less than its older bro. Some sites are reporting that the 500MHz will list for $260 by the time you read this, but for now... $440; **www.intel.com**

▶ Memory: Crucial Technology 128MB PC100 DIMM
We could have picked up a generic DIMM from Rutherford's RAM-O-Copia but we opted for a known quantity. Crucial Technology is the sole producer of SDRAM in the United States. Since Crucial cooks its own SDRAM, it's no problem for it to assemble memory modules as well. Our machine features 128MB, which is enough for our Windows 98 box. We also opted for non-ECC RAM, since we're not running a server that requires error correction. $150; **www.crucialtech.com**

▶ Hard Drive: Quantum Fireball Plus KA & Promise Ultra66 Controller
The Promise Ultra DMA 66/Quantum combo is the fastest IDE solution you'll find—at least in the absence of UDMA/66 motherboard chipset support. Quantum's kick-ass 18.2GB, 7200rpm Fireball Plus KA received a 9 verdict in the July 99 issue and surpassed all competitors in overall throughput (16.2Mbps). You won't need the Promise controller if a motherboard chipset supporting UDMA/66 becomes available. The Promise controller offers no additional speed, but does come with its own IDE channel, a feature we leveraged for our Dream Machine. Drive: $399; www.quantum.com. Card: $49; **www.promise.com**

Pentium III

Quantum Fireball

Promise Controller

HP 8200i

Pioneer ATAPI DVD-ROM

Matrox G400

Diamond MX300

▶ CD-RW: HP 8200i CD-Writer Plus
Based on Sony's CRX120E Spressa drive, the CD-Writer Plus can burn both gold and rewritable discs at 4x, and read CD-ROMs at 24x. The bundle incorporates Adaptec's tried-and-true *Easy CD Creator* and *DirectCD* packet-writing software, making the most of Sony's excellent hardware. The previous version of this HP drive received a 9/Kick Ass in February 1999. $388; **www.hpcdwriter.com**

▶ DVD-ROM: Pioneer ATAPI DVD-ROM Drive
No drive tops the Pioneer DVD-1035's performance in reading DVD discs. Our benchmarks show it reads DVD-ROMs at 6.2x and CD-ROMs at 34x. Unless you're an extremist who demands ultimate CD-ROM performance, this should be plenty. $150; **www.pioneerusa.com**

▶ Removable Storage: Iomega Zip 100
Even in the age of CD-RW, we can't ignore the Zip. With 25 million Zip drives already in circulation, chances are someone will hand you a Zip disc in the near future; you'll need a way to read it. Enclosed in a hard plastic shell, Zip media is also safer to carry around than CD-RW media. $100; **www.iomega.com**

▶ Videocard: Matrox Millennium G400 MAX
It may not be the flat-out fastest board currently available, but it's definitely the most fully rounded. Loaded with all the latest-greatest rendering features, the MAX delivers a brutal combo of great image quality and high framerates. The MAX also shines with dual-display support, real bump-mapping, and DVD playback that's strong enough for us to do without an MPEG-2 decoder card. Receives a 9/Kick Ass on page 87. $250; **www.matrox.com**

▶ Soundcard: Diamond Multimedia MX-300
The Aureal 2.0-ready MX-300 supports quad-speakers with upgrade options for full Digital Dolby 5.1 output. You may not even want to upgrade though: Using Zoran's SoftDVD support, the MX-300 virtualizes the center channel and offers four discrete channels pumped over four speakers. Watching a DVD title with quad-support will change how you hear movies. This card easily earns our blessing for severe gaming. Received a 9/Kick Ass in January 1999. $79; **www.diamondmm.com**

▶ Modem: ActionTec Call-Waiting Modem
Even if you're browsing the net, this ActionTec modem will alert you to an incoming call-waiting signal. You can then pick up the handset and talk for up to seven seconds without dropping your net connection! Although many other PCI modems off-load control to the CPU, stealing processing cycles, the Call-Waiting Modem features an onboard controller that should offer excellent performance. $105; **www.actiontec.com**

▶ OS: Windows 98
What can we say—we wanted Direct X gaming support!

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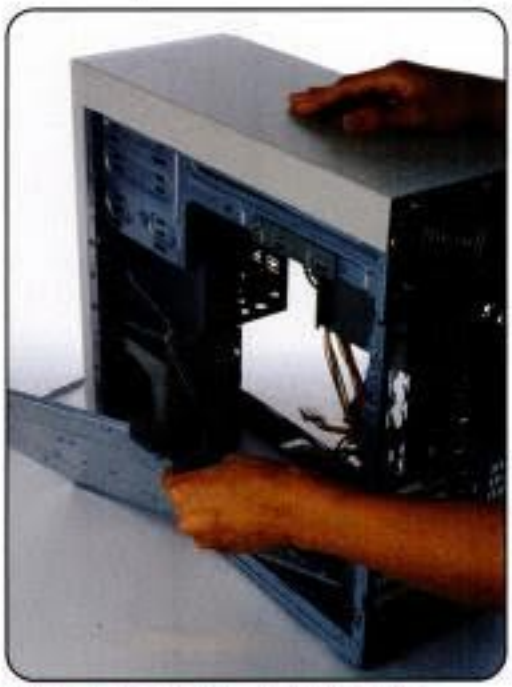
Build it.

Here are the instructions for integrating all the parts showcased on page 52. The construction of your own Dream Machine could be different, depending on the parts you choose, but in general, the following steps should serve as a universal primer. Be sure to read this entire article, and any manuals that came with your parts, before unsheathing your screwdriver.

1 Remove Mobo Tray

If you're lucky, your case has a removable motherboard mounting tray. Just unscrew the mounting tray and lay it on a flat, well-lit surface, such as your kitchen table. The worst place to build a PC is on carpet—excess static electricity will fry you mobo faster than a hippie on blotter acid.



Removable motherboard mounting trays make PC construction much easier. Instead of working in the cramped quarters of your case, you can just pop out the mounting tray and build in an open area.

To reduce the risk of shocking the bejeezus out of your motherboard or any other delicate PC component, store everything in antistatic bags. If you're a static magnet, you can always get an antistatic wristband, but simply grounding yourself by touching a metal object should be enough to protect your equipment from the dangers of electrostatic discharge.

2 Mount the Motherboard

To mount the motherboard, start by matching up the mobo screw mounts with the holes in the mounting tray. Screw the brass standoffs into the matching holes and set your motherboard on the standoffs. It's a good idea to push down on the area around the PCI slots to make sure that adding new cards won't cause the mobo to touch the metal tray and short itself out; you can add plastic standoffs to support these areas. Once the motherboard feels well supported, screw it into place.

Many motherboards, such as the Abit BX6 R2 we used, are going jumperless, meaning all bus, multiplier, and voltage settings are configured through the BIOS (see Step 13). If your mobo dates back to the jumper age, you'll need to comb through your manual and make sure the jumpers match up with appropriate CPU settings before you mount your board. Usually one jumper block sets the clock multiplier while another sets the frontside bus speed.

1. Brass or plastic standoffs are used to keep your motherboard from touching the metal tray and shorting itself out.

2. When screwing the motherboard into place, leave the screws a little loose in case you need to re-adjust the mobo's position at some point.

3 Install CPU

CPU goalposts are used to properly position slotted processors, such as our Pentium III. Each set of goalposts is different, but they should attach to the motherboard with very little fuss. Once they're erected, you should rock the posts back and forth to make sure they support the weight of the CPU and heatsink. The processor's connector is notched to go in only one way, but if you're in doubt (or you can't see the divider in the middle of the processor slot) a good rule of thumb is to face the heatsink toward the middle of the motherboard.

1. Since some goalposts have to be attached to the bottom of the motherboard, you may need to erect them before you mount the mobo on the tray.

2. Gently slide your CPU down the goalpost and into the slot. Don't force it if it doesn't want to go.

STEP PHOTOGRAPHY BY JOHN BLOHM • PRODUCT PHOTOGRAPHY BY AARON LAUER

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4 Accessorize the Mobo with Memory, Cables, & Wires

Now you need to pop in your main system memory, two IDE ribbon cables, one floppy cable, and various power wires into the motherboard.

If you're sporting a 350MHz or faster processor that isn't a Celeron, your system bus will run at 100MHz. A 100MHz bus requires PC100 or better SDRAM. Sure, PC100 memory is expensive, but with great PC power comes great big credit card bills; we plunked down the hefty ducats for a 128MB DIMM.

We chose to install the memory in the socket furthest from the IDE connectors to keep it out of trouble, but it doesn't really matter which socket holds your DIMM. Just pop the memory into place, and the clips should snap in around it.

It's much easier to attach the 40-pin IDE ribbon cables, floppy cable, and case wires while the motherboard is out of the case. When connecting the ribbon cables, pay attention to which IDE connector is the primary channel and which is secondary (they should be clearly labeled on the mobo); your hard drive will probably need to be on the primary channel in order to boot.

Now plug in all the wires that connect to the power LED, hard drive LED, internal speaker, power switch, and reset switch. Don't worry about plugging any of these wires in backward—if a light doesn't come on or the power doesn't kick in, just flip the connector and reboot. No harm done.

1. One of the nice things about DIMMs is that they don't have to be installed in pairs like SIMMs. This is because a each DIMM is equivalent to two SIMMS.

2. When you plug in your IDE and floppy ribbon cables, look for the pin1 label at the end of the connector and attach the pin1 side, or striped side, of the cable there.

3. All the case wires should be labeled, but you may need to consult your motherboard manual to figure out where they go.

5 Set IDE Master/Slave Jumpers

Before you put your IDE drives into the case, you should check your master and slave settings. Motherboards can run four IDE devices—a master device and a slave device on each channel. Unless you're booting from a SCSI hard drive or running your IDE boot drive off a separate controller like we did, you should set your hard drive as the master device on the primary channel. Since we hooked up our Quantum hard drive to the Promise controller to take advantage of wicked-fast Ultra DMA/66 throughput, we were able to set both the DVD-ROM and CD-RW drive as masters on the motherboard's separate IDE channels, and set the Zip as slave.

IDE master and slave designations are set through the jumpers on the back of each drive. Often, the drive itself will boast a little diagram of how to adjust its own jumpers.

6 Slap in the Drives

Now its time to actually put your hard drive, removable storage, and floppy drives into the case. Depending on your case's drive bay situation, you may need to install some of the drives in a removable cage or gondola, which will then later be installed into the case.

Where you install your IDE devices is largely determined by how far the ribbon cable reaches and how much space exists between the master and slave connections. If you stretch your IDE cables too tightly, they can slowly detach themselves from the IDE drives. Since we're attaching our CD-RW and DVD-ROM drives to separate IDE channels, we can space the drives apart to increase the airflow between them.

If your case has a separate hard drive gondola that sits in front of the CPU and case fan, it's better to install your hard drive there instead of in the floppy cage. The case fan will suck much of the excess heat away from the hard drive, fostering a more reliable drive. Since we're still going to need access to the PCI and AGP card slots, we installed the hard drive in its gondola, and then set the gondola to the side until Step 11.

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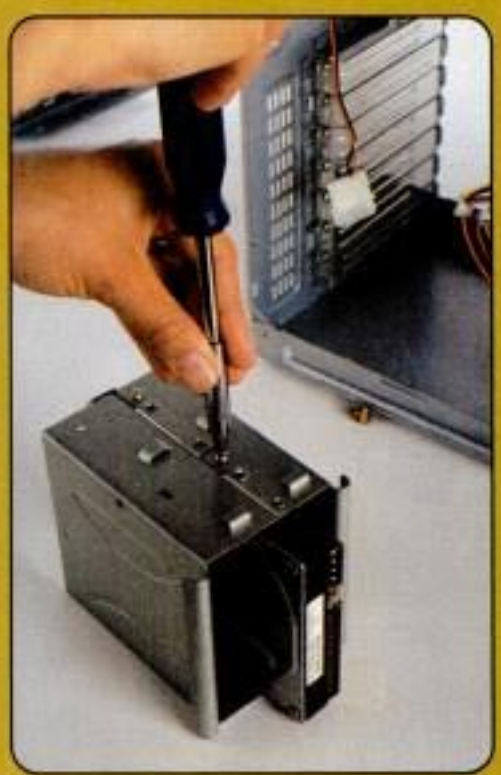
It's aesthetically pleasing when your DVD-ROM and CD-RW line up with the front bezel of the case.

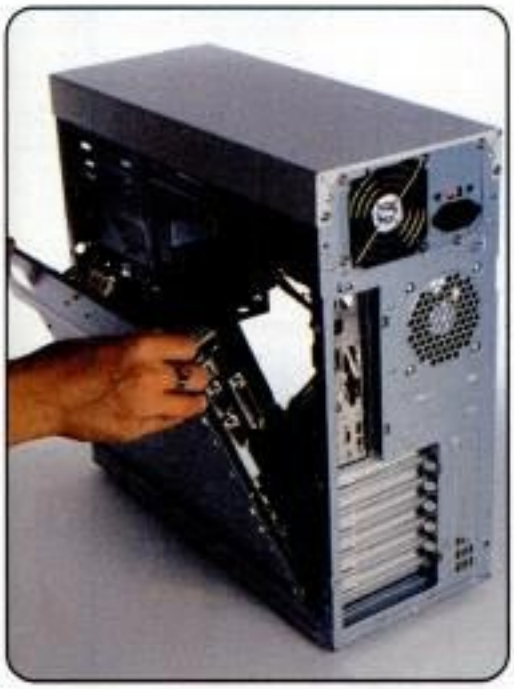
After the floppy and zip are installed in the floppy cage, just pop it back into the case.



The more screws you use to install your hard drive in the gondola, the more you'll have to unscrew to remove it. Two screws on one side and one on the other should suffice.

7 Put the Motherboard in the Case

Before reattaching the motherboard mounting tray, make sure the keyboard, USB, and other I/O ports line up with the cutouts in the rear of the case. If they don't, you may need to use another metal I/O plate cover, or punch new holes in the existing one. Once the tray is reattached, you should check before tightening down the mounting screws to see if your PCI cards fit between the edge of the mobo and back of the case.



Now you can see where Apple got the concept for the G3.

8 Connect the Power

Be careful when plugging the power supply's power connector into the motherboard. If it's a split plug like the ones used for older AT mobos, you'll want to make sure that they sit black-to-black, meaning that the black wire from one plug is beside the black wire from the other. Like most ATX motherboards, our Abit BX6's power connector is a single 20-pin plug. Once it's plugged in, give the wire a good tug to make sure your power connection is secure.

The motherboard power connector is designed to only go in one way and has a clip on one side to hold it into place. If you manage to put it in backwards, your mobo will fry.

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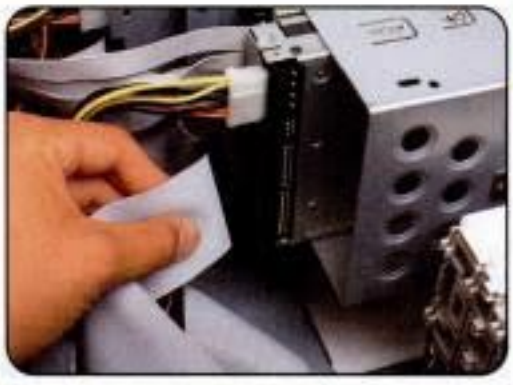
9 Hook Up Drives

Now plug the power and ribbon cables into the back of your various drive devices. Although the drive power connectors are rounded on the top, you still need to be careful not to plug them in upside down—it will fry your drive. IDE connectors usually have a notch at the top that makes connecting them properly a no-brainer, but in case you're baffled, remember that Pin 1 on the ribbon cable (the side marked with a red stripe or lettering) should match up with Pin 1 on the back of the device. As a general rule, any master IDE device

Peripheral power connectors are designed to connect only one way.



If your IDE devices are improperly connected, your PC will fail to post.

should connect to the end of the 40-pin ribbon cable; the slave device should connect to the middle. Here are the specifics of our IDE situation: We put the hard drive on the Promise card's master connector, the DVD drive on the mobo's primary master, the CD-RW drive on the mobo's secondary master, and the Zip on the mobo's secondary slave.

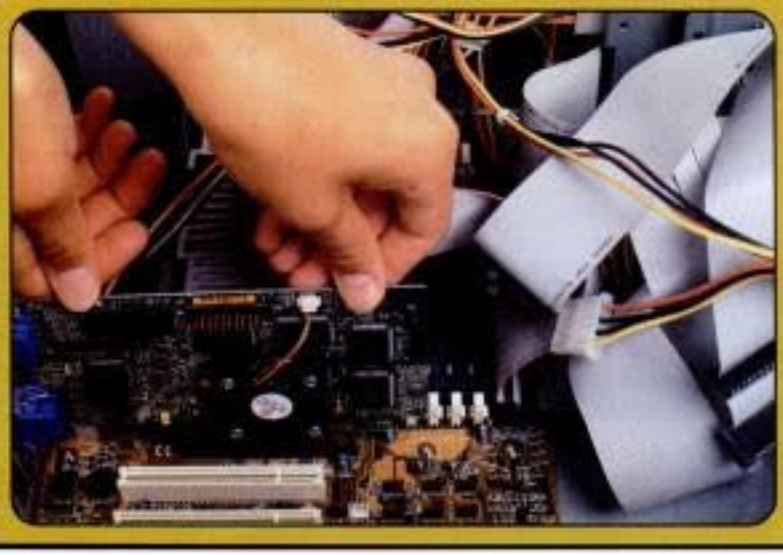
Your floppy drive connects to the last floppy connection on the 34-pin cable. If you connect the floppy cable upside down, your floppy drive will be unusable and the drive light will stay on all the time. The general rule of thumb to follow for both floppy and IDE devices is to plug Pin 1 into the side closest to the power connector.

10 Adding the Videocard

At this point, the only card you need to install is the videocard—you can add more after making sure your PC posts. It's always better to have just the bare essentials installed when you first turn on the machine, to avoid resource conflicts. For most hand-built systems, the minimum hardware needed to boot is the videocard, the motherboard, the CPU, and the memory. We added our IDE devices to the mix as well and installed the Promise controller to manage the hard drive.

The hard and fast of installing AGP and PCI cards is to just make sure the gold connectors along the bottom of the card are flush with the slot.

Some cases come with extra support brackets to hold AGP cards, but even without the extra support, our Matrox Millennium G400 MAX stayed in place.



11 Bring Back the Hard Drive

Now we can put the hard drive gondola back into the case and attach the power and ribbon cables. To take full advantage of the Ultra DMA/66 Quantum Fireball, we used an 80-conductor IDE ribbon cable, which has the same number of pins as a standard cable but doubles the conductor lines, to decrease signal crosstalk. Always try to use the screws that came with your hard drive. If you don't have the correct screw you can always use a slightly bigger screw in a smaller hole if you try hard enough.

1. Here we reattach the hard drive gondola from whence it came.

2. Attach the Ultra DMA ribbon cable from the primary channel of the Promise controller to the back of the hard drive.

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12 Boot

Now boot your PC to make sure the basic system components are recognized and working properly. As soon as you turn it on, your PC looks to the BIOS for instructions on how to load devices. The first thing the BIOS does is perform the power-on self-test (POST), a series of diagnostic tests that check the RAM, keyboard, and drives. If the POST picks up on some bad juju, it reports the errors through a series of beeps from the system speaker. POST error messages normally involve bad memory configurations or video signal errors; your motherboard manual should help you decode what the beeps mean. If your manual can't help you pinpoint the problem, you'll need to double-check each connection and make sure every device is properly seated and every cable is properly connected.

Does your screen look like this when you turn the power on? It should.

13 Install Other Cards

Once you know that your hand-built PC boots, you can turn it off and add the rest of your hardware. When installing your PCI cards, consider how your PCI bus is enumerated—the card in the first slot will be recognized before the cards down by the ISA slots. If you have the space, it's also a good idea to put some distance in between your cards (especially videocards) to keep air flowing between them. We put our Monster Sound MX-300 PCI soundcard in the slot next to the Promise controller and banished the modem to the ISA ghetto.

With everything in place, *Windows 98* will have a much better time installing all the resources necessary to keep the system happy.

If you want audio to be piped directly from your DVD/CD-ROM, you need to attach a sound cable from the back of the drive to the soundcard.

14 Set Up the BIOS

As soon as your PC successfully posts, you should set up your BIOS. To do this, you'll need to access the CMOS memory where all BIOS info—such as time, date, port settings, and drive types—is stored. The magic key that grants entry to the CMOS setup utility is normally F2 or Delete; consult your motherboard manual for specifics.

Since our Abit BX6 motherboard is jumperless,

```
CPU Name Is : Intel Pentium III MMX

CPU Operating Speed : 500(100)
- Turbo Frequency   : Disabled

CPU Power Supply    : CPU Default
- Core Voltage      : 2.00v
```

```
CPU Name Is : Intel Pentium III MMX

CPU Operating Speed : User Define
- Turbo Frequency   : Disabled
- Ext. Clock (PCI)  : 100MHz(1/3)
- Multiplier Factor : x5
- SEL100/66# Signal : High
- AGPCLK/CPUCLK     : 2/3
- L2 Cache Latency  : Default
- Speed Error Hold  : Enabled

CPU Power Supply    : CPU Default
- Core Voltage      : 2.00v
```

The Award BIOS on the BX6 includes CPU setup options that allow you either to set the CPU speed and let the clock speed and multiplier automatically configure themselves (above), or to tweak each setting manually to your liking.

the first thing we did was set the CPU clock speed. For our 500MHz Pentium III, we set the system clock to 100MHz and the multiplier to 5.0. Although it's tempting to overclock your CPU right out of the gate, it's better to make sure first that it runs at the stock setting.

On first boot, you'll also want to set the system clock and make sure the floppy and IDE settings are correct. Most modern-day BIOSes have an IDE autodetect feature, but if your drives aren't properly detected you'll need to specify everything that's hooked up to your motherboard. For hard drives this is a real pain, since you have to enter all the nasty little particulars such as landing zone, heads, and cylinders.

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15 Let Windows Screw it All Up

With all your hardware installed, you can now prep the hard drive and install the OS. You may already have Windows pre-installed on the drive, but if you don't, you'll need to boot from either a floppy or a CD, create a bootable partition on your drive, format the partition, and then load Windows into the partition.

You can make a bootable floppy by jumping on another machine and making a Windows 98 Startup Disk via the Add/Remove Programs control panel. The floppy will contain most of the DOS commands you'll need for prepping your drive.

Now boot off the floppy, and when you get to a DOS prompt, run FDISK and make a primary DOS partition of at least 1GB. FDISK is the DOS tool that creates and destroys hard drive partitions—use it only when you have nothing worth keeping on your hard drive. If you have more than one hard drive, pay very close attention to what drive you're re-partitioning, because there is no undo command in FDISK. If you want to take advantage of the higher capacities and more efficient cluster sizes that FAT32 offers, answer "yes" to the large-disk-support prompt.

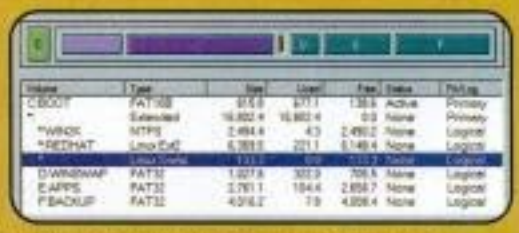
After you create your partition, you'll need to format the partition before the Windows setup will see it. To do this you need another DOS command, FORMAT, which preps your hard drive by rewriting the file allocation table and creating a new master boot record.

After you prep your hard drive with FDISK and FORMAT, copy all the Windows 98 files from the installation CD to C:\CABS (a directory that you need to create on the hard drive), and then run the Windows setup from there (just type setup when in the CABS directory). Windows installs much faster when you take this installation route. With all the CAB files on the hard drive, you also don't have to hunt down the Win98 disc every time you change a setting.

It should be noted that the Windows 98 complete installation CD is bootable (the upgrade CD isn't), so if your system supports booting from CD, this is an excellent option. When you boot from the Win98 CD, the installation process starts automatically—no messy DOS commands needed. Just set up the boot sequence in your BIOS and you're on your way. Windows will load as many device drivers as possible, but it might also prompt you for driver CDs, so be ready. After Windows fully installs, go online and hunt for the latest drivers for all your devices.

Add/Remove Programs Properties
Install/Uninstall
Windows Setup
Startup Disk
If you have trouble starting Windows 98, you can use a startup disk to start your computer, run diagnostic programs, and fix many problems.
To create a startup disk, click Create Disk. You will need one floppy disk.
Create Disk...
Preparing startup disk files...
8%

The Windows 98 startup disk includes all the files you need to create a bootable partition. It even includes generic CD-ROM DOS drivers so you can install Windows from the Win98 CD after booting to a DOS prompt.



No, you don't have to get this ambitious with your partitioning, but if you plan correctly when you FDISK your hard drive, adding new OSes later on won't mean completely wiping the drive and starting over.

During installation, Win 98 attempts to find all of the devices attached to your PC and install the appropriate driver for them. If Win 98 can't find a driver for every device, you'll need to install them through the Device Manager.

Update Device Driver Wizard
Windows driver file search for the device:
Actiontec 56K PCI Call Waiting Modem
Windows is now ready to install the best driver for this device. Click Back to select a different driver, or click Next to continue.
Location of driver:
C:\MDMATCW.INF
< Back
Next >
Cancel

After you install Windows, you should update all of your drivers. Just download the latest and greatest, open up the device properties in the Device Manager, and point the update wizard to the new drivers.

16 Mug for the Camera You're Done!

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How We Scored

Dream Machine 99 performs on par with our new baseline 500MHz Pentium III Dell test system (see page 82). While it's just a nudge better in basic CPU performance, as illustrated by the bootMark and *Photoshop* scores, it falls down in CD-ROM reads and Direct3D gaming.

Armed with the Millennium G400 MAX, it also fell a little short of the *Expendable* mark posted by the TNT2 Ultra-equipped Dell system. While we expected the MAX to match but not exceed the TNT2 Ultra, Matrox's new OpenGL ICD, which arrived at the eleventh hour, shot the Dream Machine's *Quake II* performance through the roof. Speed and beauty—no wonder we love this card.

Equipped with a 40x CD-ROM drive, the test system bent the Dream Machine over and made it squeal when it came to CD throughput. While the 6x Panasonic DVD-ROM drive is fast, it still can't pull überfast CD-ROM velocities. Of course, the Dell doesn't do movies, so there.

How to Pick the Perfect Parts

The whole point of building your own dream machine is customization—installing just the right components to fit your daily work and play routines. So if you don't want to build a machine based on the parts we listed on page 52, you'll need to pick your own—here are some general guidelines. If you don't give a damn about retirement plans and want to get nasty with the most extravagant components in the known universe, dig the extremities.

COMPONENT BUYERS GUIDE

Case We'll assume you'll be buying a traditional tower case, which comes in three sizes: mini, mid, and full. Make sure your case is large enough for your motherboard, as mobos have different formfactors as well. Mini-tower cases will house only baby-ATX formfactor motherboards. For the largest AT motherboards, we recommend full tower cases (but most mobos will fit in mid-towers as well).

Of course, the larger the case, the more room you'll have to maneuver your hands. For expansion readiness, we recommend that a case contain at least three 5.25-inch drive bays (for DVD, CD-ROM, and CD-RW), two 3.5-inch drive bays (for floppy and Zip), and at least two internal bays for your hard drives.

It's usually cheaper to purchase a case and power supply together. You should get at least a 250W supply for mini- and mid-tower cases, and at least a 300W for a full-tower case (under the assumption the larger case will contain that many more power-hungry components). Other amenities to consider are removable side panels, and additional fans that use silent ball-bearings. The fans are important for airflow and cooling, an issue with smaller cases.

Motherboard Need five PCI slots? Don't settle for an older four-slot board. Planning on overclocking? Make sure your BIOS features soft jumpers. Got a soundcard already? Don't waste money on onboard sound, which will invariably be lame. Need SCSI or network support? This type of onboard support is usually quite acceptable. Also, check the motherboard design to see if

PC EXTREME

PC Power & Cooling Deluxe Chrome Tower
This steel and deep-blue wonder comes with a removable chrome faceplate, supports ten 5.25-inch drive bays, and offers different power supply options. We chose the DualPower 600 ATX redundant, hot-swappable power system with built-in audio alarm and diagnostic LEDs. If one of the two supplies ever fails, it can be easily removed via a steel handle and replaced—all without booting down. $449 (DualPower 600 ATX redundant power system is another $389); **www.pcpowercooling.com**

Deluxe Chrome Tower

Tyan S1837UANG Thunderbolt
Packed with onboard dual-Ultra2 SCSI, 10/100BaseT Ethernet, redundant power supply plugs, and PCI sound, the Thunderbolt challenges you to find enough cards to slap into its six PCI slots. The ▶

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64MB Upgrade Comparison:

Compaq	Crucial	Kingston
Presario 4808	$58.89	141.00
Deskpro EN C400	$58.89	157.00
Deskpro EP Model 6400CDS	$58.89	141.00
Micron Electronics	**Crucial**	**Kingston**
Millennia 400	$58.89	141.00
Home MPC	$132.98	-
Powerstation P133 with 54SI BIOS	$132.98	-
ClientPro VXE 200/233	$59.84	141.00
Magnum Pro Plus P200	$132.98	-
Gateway	**Crucial**	**Kingston**
G6-300	$58.89	141.00
P5-133	$138.68	247.00
GP6-300	$58.89	141.00
IBM	**Crucial**	**Kingston**
Aptiva (2140) Model L5H	$58.89	157.00
PC 300GL Series Pentium II Systems (6591)	$58.89	157.00
PC 300PL (6892-50U)	$59.84	154.00
HP	**Crucial**	**Kingston**
Pavilion 3260	$58.89	141.00
BRIO Advanced Business Models 8338	$58.89	141.00
Vectra VL Series 8	$59.84	141.00
Apple	**Crucial**	**Kingston**
iMAC	$62.69	157.00
Performa 5400/120	$142.49	230.00
Power Mac 6100 Series	$132.98	211.00
Power Mac G3	$58.89	141.00
Power Mac G3 PC100	$59.84	141.00

(All prices were taken from the Web sites of Crucial and Kingston on 6/23/99)

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Perfect Parts

COMPONENT BUYERS GUIDE

PC EXTREME

(Motherboardboard, cont.) your cards will fit—discovering that your Bitchin'*fast*3D™ AGP card won't snap in because the manufacturer placed a component in the wrong place will break your heart. Obviously, your motherboard formfactor should complement your case design, and your motherboard chipset should support your processor. You will not find any motherboard that supports both Pentium III and Athlon CPUs (though Pentium MMX and K6-2/K6-III is another story).

Expect to lean heavily on your reseller if you have motherboard problems. Getting support from Far-Eastern motherboard companies runs from zero to fahgedaboutit. To help insulate yourself from future support dilemmas, you should cruise the manufacturer's web site before you buy. Does it feature a downloadable manual, driver and BIOS updates, and a FAQ? If you can't even find the manufacturer, don't buy the board.

440GX chipset enables the board's two Slot 1s for SMP mania, and gets the Thunder to its 2GB SDRAM maximum. $539, **www.tyan.com**

Tyan Thunderbolt

CPU The CPU decision requires a lot of soul-searching, followed by a rash jump into the abyss. Based on the findings on page 72, it seems AMD's Athlon is currently the fastest processor available. But then again, Intel's Pentium III is also extremely fast. But then again, maybe you want to save some money, buy an Intel Celeron, and then overclock it by 150MHz. Or maybe you should buy an AMD K6-III and use it exclusively for inexpensive 3DNow! gaming.

Our essential advice is to read past *Maximum PC* processor articles and make an informed decision that fits your computer use and budget. To wit: We cover Athlon in this issue; the Pentium III in March 1999; and Celeron overclocking and K6-III in April 1999.

Athlon 650MHz
As we write this, both Intel and AMD are on the verge of announcing bin jumps—the Pentium III will hit 600MHz, while the Athlon will graduate to 650MHz. Both procs will play footsie with 100MHz memory. If price were no object, we'd go with the Athlon for its sheer clock speed and architectural audacity. But to be married to which motherboard? Indeed, the Athlon mobo situation has yet to be resolved. $999; **www.amd.com**

Memory As of this writing, all high-end Wintel machines use 100MHz SDRAM (aka PC100). However, if you're building a Pentium III or Athlon system, you should look to the future and buy PC133 SDRAM, as both platforms have this memory jump in their roadmaps (with Direct RAMBUS and Double Data Rate SDRAM on the horizon).

Pay close attention to what your motherboard manufacturer recommends; we once ran into a nasty compatibility problem when we bought nonbuffered memory for a buffered mobo. Mobo makers will test RAM for full compatibility and list approved modules. If you just can't resist that blue light special, conduct stringent system testing in the first few days of birth to ensure your RAM is performing up to snuff. For a rigorous workout, check out Ultra-X's RAM Stress Tester (www.ultra-x.com).

Corsair Memory PC133 256MB DIMM
Even though current Pentium III motherboards don't support PC133 directly, buying the higher-speed SDRAM will serve anyone who needs to cannibalize his system for an upgrade down the road. Expecting a move to Windows 2000 Pro? Then opt for a 256MB DIMM. $174; **www.corsairmicro.com**

Hard Drive Your hard drive purchase will in part depend on whether your mobo supports UDMA/66 or a SCSI version. That is, if you have your heart set on a fast UDMA/66 or SCSI drive—both of which offer faster maximum throughput than UDMA/33—you'll need either onboard support or a controller card stuffed in a PCI slot.

SCSI runs better in multitasking environments than UDMA/66, supports up to 15 devices per channel, can pump more data through its bus, and can execute up to 256 commands concurrently via a cool feature called Command Tag Queuing. UDMA/66, on the other hand, must wait for each I/O request to be completed before it can begin another. This is noticeable when running multiple applications and copying large amounts of data—UDMA/66 just bogs down while SCSI runs along smoothly. But, of course, UDMA/66 is cheaper. If you're taking the SCSI hard drive path, go Ultra2 for its superior voltage regulation and termination.

The faster the spindle rotation, the faster the hard drive. UDMA drives currently top out at 7,200rpm while SCSI drives hit 10,000rpm (the 12,000rpm from Hitachi uses smaller platters, so it's not actually as fast as you think). The size of the onboard cache is important, but so are the drives' algorithms that

Dual 9GB IBM Ultrastar Ultra2 SCSI Drives
Why not stripe two superfast Ultra2 SCSI drives together in a RAID array for twice the performance? Of course, if you go this route, your motherboard will need to support both Ultra2 SCSI and RAID, but once those two Ultrastars hit their stride, you'll see bus stuffing performance that'll leave you dizzy. If you want to stay in the land of IDE, you can buy Promise's FastTrack66 controller card and run two UDMA/66 drives in tandem for RAID on the cheap. $625 X 2; **www.storage.ibm.com**

IBM Ultrastar

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COMPONENT BUYERS GUIDE	PC EXTREME
(Hard Drive, cont.) utilize the cache. So don't be swayed by sheer numbers; look to the real-world benchmarks in the July 1999 hard drive feature. As for capacities, the larger the drive, the slower the overall throughput. Larger drives get slower toward the inside of the platter, meaning the first few gigs of data will transfer a lot faster than the gigs located toward the end.	
CD-RW Your main concerns will be write/rewrite/read speeds and bundled software. Currently, industry write speeds top out at 8x, rewrite speeds at 4x, and read speeds at 24x—but you probably won't get this combination in one drive. For example, the new Plextor drive is 8x/2x/20x, while the new HP drive is 4x/4x/24x. Read speeds are important if you plan to use your CD-RW as a CD-ROM drive replacement. Just remember that you might want to use a CD-RW in tandem with a CD-ROM or DVD-ROM drive so you can write data and CD audio files directly to the burner. As for bundled software, we prefer Adaptec's super-stable *Easy CD Creator*, which is one of the best software packages for making music CDs.	**Plextor PlexWriter 8x2x20x** Plextor's Kick Ass 8x recorder now incorporates CD-RW capabilities. Although it doesn't boast the 4x rewritable speed of the HP CD-Writer Plus, the SCSI-based PlexWriter does burn a CD-R disc in less than nine minutes. And with a 4MB cache, buffer underruns should never cross your path. $569; **www.plextor.com**
DVD-ROM Why even buy a CD-ROM drive? The current crop of 5x and 6x DVD drives don't cost much more than a CD-ROM drive, offer CD read speeds of up to 32x, and offer all the CD support of CD-ROM drive, since they comply with the multiread specification. Older DVD drives in the 2x and 4x speed ranges also comply, but are comparatively buggy. Of course, when you choose DVD, you get the opportunity to play DVD movies on your computer—which demands some type of decoding strategy. Many DVD drives come in kits with bundled MPEG-2 decoder cards. We prefer the Sigma Designs Hollywood+ decoder for its sharp output on both computer monitors and TVs. This card, like all good decoders, offers output support for Dolby Digital 5.1 and Dolby ProLogic surround sound, both of which can give you a theater-like listening experience. If your DVD kit doesn't come with a PCI decoder card, you should make sure your videocard is ready to assume decoding duties. If you're stuck on buying a CD-ROM drive for sheer read speeds, you should be aware of some issues with products we've recommended in the past. Read this month's Watchdog section for information on Kenwood's 40x and 52x drives.	**Pioneer SCSI DVD Drive & REALmagic Hollywood+ MPEG-2/DVD Decoder** Trash that crappy software decoder and upgrade to the Hollywood+, the sharpest damn hardware decoder we've ever seen. Backed with a Pioneer SCSI DVD drive, you'll never need to worry about dropped frames while simultaneously downloading heavy content or crunching hard data in the background. The Hollywood+ also brings full Dolby Digital 5.1 support to the table, for hardcore audiophiles. $319 (in a bundle offered by Hi-Val); **www.hival.com** Pioneer DVD-ROM Drive
Removable Storage There are plenty of options available: Iomega Zip (100MB/250MB), Iomega Jaz (1GB/2GB), CD-RW (650MB), and DVD-RAM (5.2GB). And this month the new Castlewood ORB (2.2GB) wins a Kick Ass award. But before you go for ultimate giggage, consider that in every machine, media support you might encounter is of paramount importance. CD-RW media can only be read by modern multiread CD/DVD-ROM drives. DVD-RAM can only be read by DVD-RAM drives. The ORB is similarly egocentric. Of course, Zip media can only be read by Zip drives, but because so many drives are in circulation, they've almost replaced the floppy. We simply won't touch a machine without a Zip drive.	**Castlewood ORB** This 2.2GB proprietary wildebeest passed our muster with engineering based on tried-and-true magnetoresistive (MR) technology. Throughput scores soar over Iomega's 2GB Jaz, and unlike the Jaz, ORB reliability has not yet emerged as an issue. Although the drive isn't yet a standard—no removable backup solutions in this size range are—we can hope that its adoption will grow, especially with the upcoming SCSI, USB, and IEEE 1394 versions. Drive: $200, cartridge: $30; **www.castlewood.com**
Videocard The 3D chipsets powering today's best cards are basically last year's chipsets fully realized. The Voodoo^3 is the Banshee sped up and done right; the TNT2 is a faster version of the TNT; and the Savage4 is everything the Savage3D should have been. This isn't a bad thing if you're looking to upgrade, since the field is populated with a lot of competent 3D cards. From the underpowered Savage4 to the überpowered TNT2 Ultra, the new video chipsets are	**Videocard: Hercules Dynamite TNT2 Ultra** Consider this board the most highly evolved member of the TNT architecture. Hercules arms its explosive 32MB board with the fastest bus speed and memory available on any 3D card. If that isn't enough power, you can always overclock the ▶

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Buyer's Guide.

COMPONENT BUYERS GUIDE

(Videocard, cont.) all feature-rich rendering machines.

But not every card is Dream Machine–worthy. Although S3 Texture Compression looks compelling, Savage4 boards are too damn slow. And Voodoo^3 cards are limited to 16-bit rendering and 256x256 pixel textures, while every other card is doing 32-bit color and maxing out the AGP bus with high-detail, 2048x2048 textures.

The fall holds big architectural leaps for almost all the 3D chips. Quad-texturing is the next must-have feature, while geometry acceleration brings the transform and lighting stages of the 3D pipeline onboard the videocard and off the much-harangued CPU. Besides freeing the CPU for other tasks, this also allows the 3D chipset to speed up these computations with a dedicated geometry processor. If you're happy with the card you have now, it may be worth the wait to upgrade at the end of the year.

PC EXTREME

card with the Hercumeter until it runs like a Chihuahua on a Frappuccino binge. Yes, the power is intoxicating. Even in games pumped up with advanced lighting and multitexturing effects, the Dynamite lays down smooth framerates. Its only weakness is video playback; for that you'll need a separate MPEG-2 decoder. $250; **www.hercules.com**

Hercules Dynamite TNT Ultra

Soundcard You can toss out that moldy ISA Sound Blaster 16 you've been holding on to since *Miami Vice* went off the air. Today, if you're looking for a high-end consumer soundcard, you'll go with a Creative Labs SoundBlaster Live! or a card based on Aureal's Vortex chipset (such as Diamond Multimedia's MX-300 or Turtle Beach's Quadzilla). The Creative and Vortex chipsets both offer 3D positional audio, but use different technology to make it happen. Although not fully tested, the VLSI Thunderbird 128 offers performance and features without the cost. Stay tuned for our verdict.

When filling out a checklist of must-have soundcard features, look for hardware wavetable support, DirectSound/DirectSound3D support, EAX or A3D compliance, and quad-sound output. At the least, you'll be able to simultaneously connect headphones and stereo speakers, and in best-case scenarios you'll be pumping sweet sounds through four discrete speakers.

Creative Labs SoundBlaster Live!

It's really a Ford vs. Chevy debate when it comes to picking soundcards. For our zany soundcard pick, we believe the EAX-based SoundBlaster Live! edges out the Aureal-based Diamond MX-300. Though current Live! versions lack Dolby Digital support, Creative Labs' engineers have been banging the anvil into the night to provide new and improved drivers every month. The Live! is simply a better overall soundcard experience than the MX-300. $199, **www.soundblaster.com**

Modem Analog modem technology is just waiting for someone to shovel six feet of dirt on top of it. Still, most everyone needs a simple 56K. In this field, U.S. Robotics dominates with its rock-solid modems, while Diamond is right on its heels. External modems save you a slot, while internal modems keep yet another piece of hardware off your desk.

When selecting an internal modem, gamers will generally want to stick with ISA modems, which feature onboard controllers (many of today's low-cost PCI modems are controllerless, and sap precious CPU cycles to get the job done). WinModems, which rely on the CPU and operating system to control the flow of data, are also a bad choice if you ever plan to use an alternate OS, such as BeOS or Linux. Our ActionTec PCI modem was a rare find—it included an onboard controller and came with Linux drivers.

Although they're pricier, external modems continue to offer redeeming qualities, such as an external power switch and LED status lights. If you're thinking USB, consider a modem that offers both USB and a standard serial connector, for times when USB falls flat. Again, the dilemma with some USB modems is that they rely on the OS and CPU to play traffic cop with the data.

Any DSL will do ya

Right here, right now, DSL and all of its variants offer the best IP throughput around. In the San Francisco Bay Area, ConcentricDSL offers upstream/downstream speeds of 768/768Kbps, 1.1/1.1Mbps, and 1.54Mbps/384Kbps. Your DSL provider (should you be lucky enough to have one in your area) will set you up with a modem, so we won't mention any specific hardware here. Prices vary, **www.adsl.com**

Damn, DSL is fast!

OS If you're running all the latest games and hardware, you'll want *Windows 98* for the highest level of compatibility. Choose *Windows NT 4.0* if you're interested in running workstation-level video or 3D rendering apps, and want dual-processor support. If you're setting up a web server or interested in learning your way around a clean, 32-bit environment, then track down a Linux install and get busy.

Linux

If you're looking for a super-stable platform that runs like the dickens, Linux is your OS. It's a fast, multithreaded, 32-bit environment that rips through the relatively few apps written for it with nary a crash. It's easy to understand why the web is served up by Linux boxes—it's so easy to set up a web server and make it secure. And once you get a Linux box running, it doesn't stop until you tell it to. $0, **www.linux.org** ●

Need more Dream Machine info?

RAQ Send your **R**arely **A**sked **Q**uestions to the e-mail below, then watch **www.maximumpcmag.com/raq** for your answers.

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Explore the potential of e-commerce, like showing panoramic movies of real estate or visiting travel & leisure destinations. Incorporate object movies for on-line product catalogs, training & instruction and more. Create multi-node virtual environments with panoramas, objects, still images and linear movies. So many things, from products to parts, artifacts to works of art, show-rooms to corporate facilities come to life when viewed from any vantage point...the possibilities are endless.

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VR PanoWorx™

PANORAMIC

Panoramic movies show the viewer a full 360 degrees vista. The movie is built out of a series of still photographic images, stitched together to form a single flat panoramic image which is wrapped into a barrel and seamed together. The viewer is placed inside, seeing the interior of the barrel as a panoramic vista. The viewer can look left, right, up and down, turning around to see all views of the 360 degree panoramic scene.

Photography by Eric Poppleton • www.epop.com

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VR ObjectWorx™

OBJECT

Object movies feature multidimensional views of a particular object. The movie is constructed out of a series of still images (usually 36 for a single band, up to 684 for a full pole-to-pole multiband object movie) which it compiles to create the illusion of a three-dimensional subject. The viewer is given the impression that they are "holding" the object in their hand. They can then rotate it and even tumble it to view all of its sides from any direction.

Photography by Arcamedia • www.arcamedia.com

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VR SceneWorx™

SCENE

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it's a hit

Athlon, AMD's most high-powered CPU ever, is primed to bump off Intel with a single, decisive shot.

by jon phillips

What the hell's an Athlon?

Advanced Micro Devices' next-gen processor (first previewed in our January '99 issue) was code-named K7 but renamed Athlon for its public launch. AMD wanted to shed negative baggage attached to the underperforming "K" nomenclature, so it went with a name that alludes to a spry, "athletic" core architecture.

At 500, 550, 600, and 650MHz, the Athlon launches as the speediest Win98/NT processor available, a full 50MHz faster than Intel's fastest Pentium III at press time. But Athlon brings much more to the motherboard than fast clock speeds. Its core architecture, cache, and CPU-to-memory channel should give you unparalleled PC performance.

At launch, AMD is pitting the Athlon squarely against the Pentium III in the "performance desktop" arena. As the Athlon matures in 2000, it will be used in multiprocessor Windows NT workstations and servers, and go head-to-head with Pentium III Xeons.

How do Athlon and P-III differ?

Both processors are superpipelined, superscalar CPUs that can execute three x86 instructions per clock cycle. The Athlon core, however, has a more ambitious internal processing strategy than the Pentium III's P6 core, so it should achieve its maximum instructions-per-cycle capacity more often than the P-III (CPUs only hit their theoretical instruction-execution plateaus under ideal conditions).

AMD also says the Athlon core is more advanced than the P6 core because is has three floating-point pipelines to the P6's two, and can digest a floating-point multiply instruction every clock cycle, while the P6 core can only pull off an "FMUL" every other clock cycle. The Athlon's ostensibly superior floating-point power should make it the preeminent CPU for 3D gaming and heavy-duty creativity apps such as 3D renderers and image editors.

For definitions of terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

What about cache and memory?

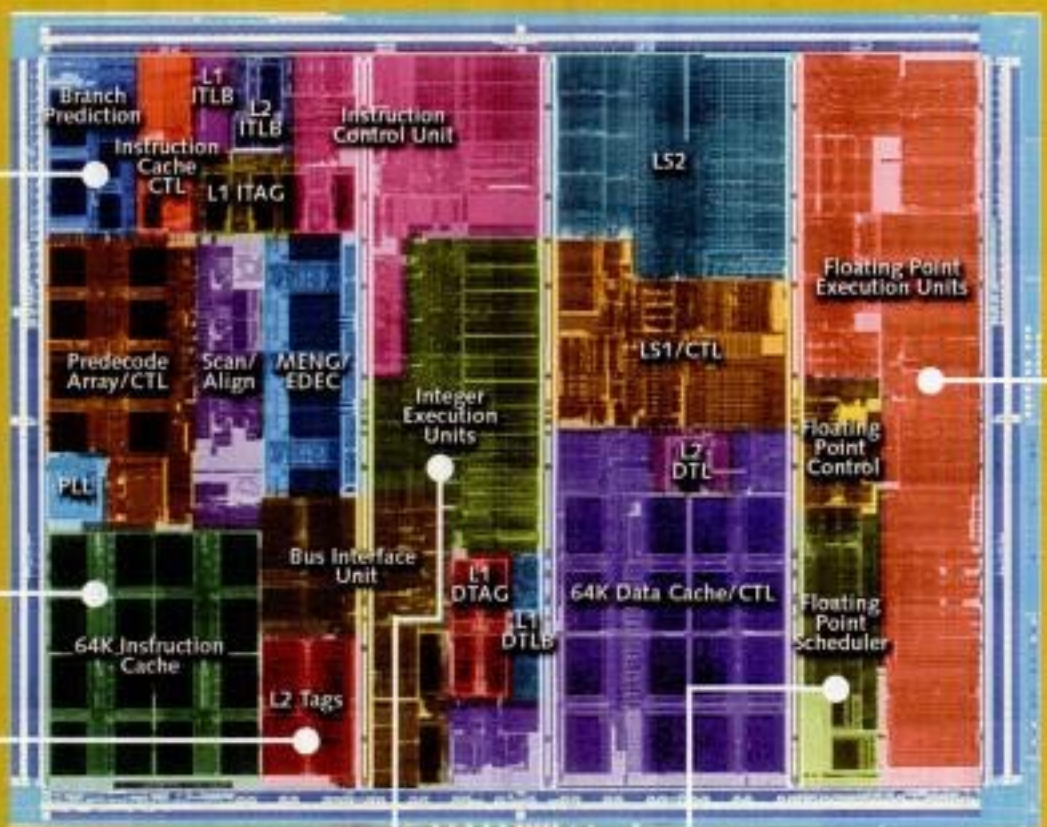
The Athlon L1 and L2 cache architecture also whomps the Pentium III cache schema. Processor cache is essentially high-speed memory that stores frequently used instructions and data. When the CPU needs a specific instruction or piece of data to crunch, it first looks for it in L1 cache. If the data isn't available there, the CPU suffers a "cache miss" and turns to L2, a slightly slower proposition. If the fodder isn't available in L2, the CPU turns to even slower main memory, and then the booty-slow hard drive as a last resort.

Long story made short: The Athlon has a 128K L1 cache, while the P-III has just a 32K L1 cache—and a larger cache equals faster processing. Both CPUs currently boast a 512K L2 cache running at half the core-processor speed, but the Athlon's L2 can ramp up to a freaky 8MB at full core-processor speed. Intel will eventually introduce full-speed L2 in its Pentium III line, but don't expect much more than 256K.

Athlon systems also offer a faster CPU-to-main memory channel than P-III systems, care of Alpha EV6 technology licensed from Digital. At launch, the Athlon's CPU-to-memory channel will run at 200MHz; the P-III's memory bus currently runs at just 100MHz and won't graduate to 133MHz until the Intel 820 core-logic chipset is released (by the end of the year if we're lucky). It's also important to note that the Athlon speaks to its core-logic chipset (and therefore main system memory) over an exclusive channel. No other devices can suck this 200MHz bandwidth, which is extremely important for performance in multiprocessor systems. The Pentium III frontside bus, meanwhile, has to deal with overhead from PCI devices and the AGP graphics card.

A die to DiE for

Here it is, up close and personal, the most advanced x86 processor ever conceived. The Athlon will be fabbed at a 0.25-micron process at launch, move to a 0.18-micron aluminum process by the end of the year, and hit 0.18-micron copper in the first half of 2000. The first Athlons will comprise 22 million transistors in a 184mm^2 die (compare that to the Pentium III's 9.5 million transistors). The Athlon die will shrink to 100mm^2 when the process moves to aluminum.



Branch Prediction Unit: Prediction logic helps the CPU to correctly determine the next set of instructions to chew on well before the processor needs it. This helps the CPU to always operate at peak performance. In superpipelined processors, good branch prediction is imperative in ensuring that each pipeline stage is working on the right instruction—the entire multistaged pipeline must be purged if the CPU is chewing on the wrong data.

64K Instruction/64K Data L1 Cache: AMD determined that a vast, 128K L1 cache was de rigueur for its architecture. By keeping frequently used data and instructions as close as possible to the CPU core, the Athlon minimizes cache misses that would send the processor to look for fodder in L2 cache and main memory.

L2 Tags: This on-die L2 cache controller precludes the need for external tag RAM for the first 512K of L2 cache. For systems with more than 512K of L2 cache, the L2 Tag unit serves as a "partial tag" for the outstanding cache, ferreting out data hidden in main system memory in the event of a cache miss.

Integer Execution Units: The Athlon rings in with six independent integer pipelines: three dedicated to integer loads and stores, three dedicated to x86 integer calculations. The CPU's scheduler units make sure that FP and integer calculations can be executed in almost any combination.

Floating-Point Scheduler: Takes FP application code and re-orders it as necessary to help the CPU achieve its maximum execution of three FP instructions per clock cycle as often as possible.

Floating-Point Execution Units: AMD has dedicated an unprecedented amount of its total circuit allotment to floating-point execution. The Athlon's three floating-point pipelines can do an FP add, FP multiply, and FP store in a single clock cycle.

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And 3DNow!?

AMD has added 19 new SIMD integer instructions to its 3DNow! catalog. These 19 newbies actually exceed Intel's original MMX set, and are designed to assist in speech recognition, video encoding, and streaming media apps. 3DNow! has also been augmented by five new DSP instructions that help the Athlon assume responsibility for soft modem, soft DSL modem, AC-3, and MP3 processing duties. As far as crunching floating-point calculations in 3D games, 3DNow! is still essentially equal in power to Intel's SSE instruction set.

Does the Athlon kick P-III ass in real-life apps?

Yes. The benchmark results on pages 72 and 73 illustrate the Athlon's superiority—but we had hoped to see even better performance. Part of the problem is that Athlon systems at launch will use 100MHz SDRAM instead of faster memory that can leverage the full potential of the 200MHz EV6 technology. This isn't AMD's fault; the company is simply going with the fastest memory currently available in large quantities. At the end of this Q&A section, we detail the Athlon's memory roadmap.

At 500, 550, 600, and 650MHz, the Athlon launches as the speediest Win98/NT processor available, a full 50MHz faster than Intel's fastest Pentium III at press time.

How do I Upgrade?

If you want dance the Athlon hustle, you'll have to either buy a pre-fab system, or hunt down an Athlon-compatible motherboard and jimmy it into your existing system—the CPU is not compatible with any existing Slot 1, Celeron/P-II/P-III motherboards. The Athlon fits into "Slot A," which is physically identical to Intel's Slot 1 but "electrically incompatible." OEMs on the Athlon track include Compaq, Cybermax, Everex, Gateway, IBM, and Kryotech. Motherboard partners are listed in the sidebar to the right. In lots of 1,000, Athlon is currently priced at $324 for a 500MHz; $479 for a 550MHz; $699 for a 600MHz; and $999 for a 650MHz.

Does the EV6 bus require special chipset support?

Yes. The Athlon and its memory technology requires specific chipset support (hence the need for a non-Intel mobo). AMD will be selling its own home-grown Athlon chipset, the AMD-750, to third-party motherboard manufacturers.

The AMD-750's northbridge chip (aka AMD-751) supports the 200MHz memory channel, AGP 2x, the PCI 2.2 spec, and PC100 SDRAM—AGP 4x and faster memory support will appear in revisions. The chipset's southbridge chip supports UDMA/66, 4-port USB, the PCI-ISA bridge, plug-n-play support, power management features, and all the other ho-hum features you'd find in any southie.

Mobos & Chipsets: the Athlon Upgrade

If you want to upgrade your existing PC with an Athlon, you'll need to dump your current motherboard for a Slot A dealie. At press time, AMD had announced the following motherboard partners: Asus, Biostar, Gigabyte, GVC, FIC, and Microstar. Boards from these companies will invariably use core-logic chipsets from AMD, ALi, SiS, and VIA.

As always, getting solid information from far-eastern companies is a battle of timezones and language barriers. Nonetheless, VIA and a number of mobo manufacturers were able to fill us in on their shenanigans. First, the skinny on VIA (www.viatech.com):

The VIA Athlon chipset will include one of the two southbridge chips already used in VIA's Socket 7 and Slot 1 offerings. This southie includes support for the standard PCI-ISA bridge, ATA33/66, hardware monitoring, and rudimentary audio and modem functions. VIA's Athlon-specific northbridge chip will differ from AMD's own northie by supporting AGP 4x and PC133 memory (up to 2GB) from the get-go. VIA's northbridge will eventually support DDR-SDRAM (as should all future VIA chipsets) and might sometime include integrated video, but will never get into multiprocessor support, which AMD wants to handle with its own northie. VIA has no plans to support Alpha CPUs.

Here's a quick rundown on the placa madre picture as we know it:

- **Asus (www.asus.com.tw)** Asus's ATX board is going with the AMD northbridge and VIA southbridge. Memory maxes out at 768MB of PC100 SDRAM. Expect AGP 2x and UDMA/66, basic sound functionality, hard jumpers on the PCB, and soft jumpers in the BIOS.
- **Biostar (www.biostar.com.tw)** The first Biostar Athlon boards will be ATX and ship with the AMD chipset, but later move to mini-ATX and core-logic from VIA and SiS. The initial board support is pretty standard: 768MB max of PC100 SDRAM, AGP 2x, UDMA/66, and no onboard sound, SCSI, or Ethernet. Biostar is going with hard jumpers.
- **FIC (www.fic.com.tw)** FIC's mini-ATX board will be called the SD11. It will use the AMD-750 chipset, and come with four PCI slots complemented by three ISA. The board supports AGP 2X, UDMA/66, and three DIMMs worth of PC100 SDRAM for a 768MB maximum.
- **Gigabyte (www.gigabyte.com.tw)** The Gigabyte motherboard will be ATX, use the AMD-750 chipset, and come with five PCI slots. It will support up to 768MB of PC100 SDRAM, AGP 2X, and UDMA/66. The board will include no onboard sound, SCSI, or Ethernet support, but will include health monitoring and system power management. Gigabyte is going "jumperless"—the board will auto-detect speeds based on a CPU ID.

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If you want to dance the Athlon hustle, you'll have to either buy a pre-fab system, or hunt down an Athlon-compatible motherboard and jimmy it into your existing system.

What about overclocking?

Good luck. While some motherboard companies are saying they'll provide soft jumpers for adjusting clock speeds, AMD says all Athlon motherboards will auto-detect CPU speeds by reading hard-coded silicon on the Athlon cartridge. This hard-coded speed information can be adjusted—if you have the right factory equipment.

What's in the Athlon future?

At 0.25-micron, AMD says the Athlon has quite a lot of headroom beyond 650MHz—expect 700MHz by the end of the year. When the CPU jumps to a 0.18-micron process in 2000, expect speeds of 1GHz and faster. The 200MHz EV6 bus will eventually graduate to 266MHz and 400MHz for workstation/server boxes.

Accordingly, memory schemes will also accelerate, but at a pace no faster than industry yields will allow. PC133 support (care of a VIA chipset if not AMD core-logic) will hopefully appear this year. AMD says 300MHz and 400MHz RAMBUS support, along with 100MHz and 133MHz DDR SDRAM, should arrive in the first half of 2000.

Memory technology can be confusing, but the general rub on RAMBUS is that it offers high data bandwidth (that is, high frequency speeds) but with high latency, which can impede overall performance. Meanwhile the "DDR" in DDR SDRAM stands for "double data rate"—the memory transfers data on both edges of each clock cycle, effectively doubling throughput (so don't be alarmed by the low speed designations).

L2 cache sizes and speeds will increase (up to 8MB at full processor speed) when AMD introduces its Athlon Ultra line next year. These Ultra boxes will be multi-proc server machines, so don't expect cache heaven in the consumer arena. ●

The proof: benchmarks

Athlon vs. Pentium III—Dare to Compare

The question on most readers' minds is, can the Athlon whoop Intel's best? To find out, we pitted a 600MHz, AMD-built Athlon test system against a full-loaded 550MHz Pentium III system in 10 different Win98 tests. Why not use Windows NT and a 550MHz Xeon, you ask? Because during this stage of the roll-out, Athlon will appear only in "performance desktop" machines, and we wanted a logical pricing match-up between AMD and Intel. AMD's latest-greatest will compete in the NT/Xeon zone when cache sizes and speeds increase, and multiprocessing kicks in.

At press time, Intel didn't have a 600MHz P-III ready for an apples-to-apples comparison. Regardless, we did try to match up our two test beds as closely as possible. While the test CPUs ran at different speeds and the Athlon carried 128K of L1 cache to the P-III's 32K, both procs boasted 512K of half-speed L2. Likewise, both test systems ran 128MB of 100MHz SDRAM and 32MB TNT2 Ultra videocards. When the P-III hits 600MHz, we will post new comparative scores online.

The Athlon system's hard drive ran on the Ultra ATA/66 bus, which is already supported by the AMD 750 chipset; Intel performance chipsets won't support Ultra ATA/66 until the Intel 820 arrives. Actually, we don't think the hard drive disparity is germane because ATA/66 transfer speeds really only kick in during drive cache bursts, and our particular tests almost never touch the hard drive.

The benchmarks indicate that AMD's current best is clearly faster than Intel's current best. Still, in some of our real-world tests, we expected to see even more power from the Athlon, considering its 50MHz clock advantage, larger L1 cache, and more advanced core architecture. It's likely that the Athlon rarely (if ever) executes its theoretical maximum of nine RISC-like operations per cycle when running our particular Win98 benchmarks. Indeed, the first iteration of Athlon may be more similar to the Pentium III than we had originally considered: Currently, both CPUs are bottlenecked by 100MHz memory and top out at 512K of half-speed L2 cache. And while the Athlon's superscalar core is more advanced than the Pentium III's, neither CPU can execute more than three x86 program instructions per clock cycle, even under ideal conditions.

THE TEST This benchmark suite times scripted runs through a bunch of real-world content-creation and business apps, and spits out a cumulative score based on an abstract scale. The suite includes a nice mixture of integer- and floating-point-intensive programs, including *Bryce 2*, *CorelDraw 8*, *Netscape 4.05*, *Photoshop 4.01*, *Premiere 4.2*, and *Word 97*. In the past, AMD has complained that *SYSmark* is too floating-point intensive and not representative of what "real users" typically use. Obviously, there's nothing to gripe about anymore. Learn more about *SYSmark* at **www.bapco.com**.

THE TEST Based on Symantec's System Information test, this benchmark taxes raw integer power, L1 and L2 cache, the core-logic chipset, and the memory bus, and then coughs up a score based on an abstract scale. The 600MHz Athlon's 43-point victory over the 550MHz P-III is especially telling given that 550MHz P-IIIs typically beat 500MHz P-IIIs by about 15 points. In other words, this synthetic benchmark suggests there's more to the Athlon than just a simple 50MHz bin advantage.

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THE TEST This photo-finish tie was the most baffling result in all of our benchmarking. *Inspire* is a 3D rendering program; our specific benchmark times how long it takes to fully render a complex scene of raytraced shadows, reflections, and refractions. The test is very floating-point intensive, but makes use of neither SSE nor 3DNow!, so we expected the Athlon to win by sheer force of clock speed, L1 cache, and advanced core architecture. It will be interesting to see what happens when both processor families scale to higher clock speeds; we sincerely doubt the test is locked in at a 401-second plateau.

THE TEST Not to be confused with the *Photoshop* portion of *SYSmark98* or Intel's floating-point-heavy *Photoshop* script for SSE testing, *Maximum PC*'s own *Photoshop* test is a sober mixture of integer and floating-point actions. Among other activity, our script includes image resizing, color palette conversion, image rotation, format conversion, and various effects filters—watercolor, gaussian blur, lens flare, and lighting effects, to name a few. One would expect the Athlon to decisively kick ass in *Photoshop*, but the results here suggest the P-III takes advantage of SSE optimizations in the effects filters (version 5.2 is optimized for SSE but not 3DNow!).

THE TEST The CPUMark is a subset of Futuremark's *3DMark99 Max*, a 3D accelerator benchmarking suite. This test runs synthetic polygon and lighting data through the CPU, without sending any data whatsoever to the 3D card itself. In other words, the benchmark tests how well the CPU handles its portion of the 3D pipeline. Both AMD's 3DNow! and Intel's SSE instructions are enabled in the test, so you can rest assured that floating-point power is pushed to the max. The Athlon's score would indicate it is a far superior processor of 3D geometry—at least in a synthetic benchmark.

THE TEST These are the exact same tests we used in our Pentium III benchmarking in the March issue. Like *SYSmark98*, these tests run action scripts through commercially-available, real-world applications and spit out an abstract score (higher is better). But these scripts were created by Intel to highlight the power of its SSE instructions. So what can we learn from the results? Essentially, certain *Photoshop* filters can make wonderful use of SSE; *Photoshop* currently doesn't leverage 3DNow! instructions. On the flipside, even without the help of extra SIMD power, the Athlon can more than hold its own in video encoding tasks—it beat the P-III in Intel's own script!

THE TEST Compared to the single-player demo2.dm2 frame rate test used in our videocard testing, the multiplayer crusher.dm2 test is much more CPU-intensive—the processor has to track the coordinates of numerous players and the physics of how these players interact with their environment. The executable used for the above score was 3DNow! optimized; this variable should be factored into the Athlon's 9-frame victory. On the Athlon, a standard *Quake II* executable trailed the 3DNow! executable by just a few frames, and still ran faster than any *Quake II* executable on the P-III.

the Upshot

If you must have the absolute fastest Win98 processor, go for the Athlon—just don't expect across-the-board wonders. Some 3D games just don't need that much more CPU power, and other games' frame rates are actually bottlenecked by the videocard, so performance dividends offered by the CPU may never be realized in faster frames. If you're an application junkie as opposed to a gamer, the Athlon is at least as good a choice as the Pentium III—unless the applications that you use the most are heavily optimized for SSE.

THE TEST This 3D game from Rage is rife with intense rendering effects, but doesn't include a lot of physics tracking, advanced AI, or high-polygon count models—the kind of floating-point-intensive features that really tax a processor. So while *Expendable* isn't the most telling CPU benchmark, it does show how much (or little) an improved floating-point engine can help games of this type.

TEST BEDS: AMD 600MHz Athlon, 128K full-speed L1 cache, 512K half-speed L2 cache, 200MHz CPU-to-chipset bus, 128MB 100MHz SDRAM, 32MB TNT2 Ultra, Creative Labs Sound Blaster Live!, 7200rpm ATA/66 hard drive, Windows 98; Intel 550MHz Pentium III, 32K full-speed L1 cache, 512K half-speed L2 cache, 100MHz memory bus, 128MB 100MHz SDRAM, 32MB TNT2 Ultra, Creative Labs Sound Blaster Live!, 7200rpm ATA/33 hard drive, Windows 98

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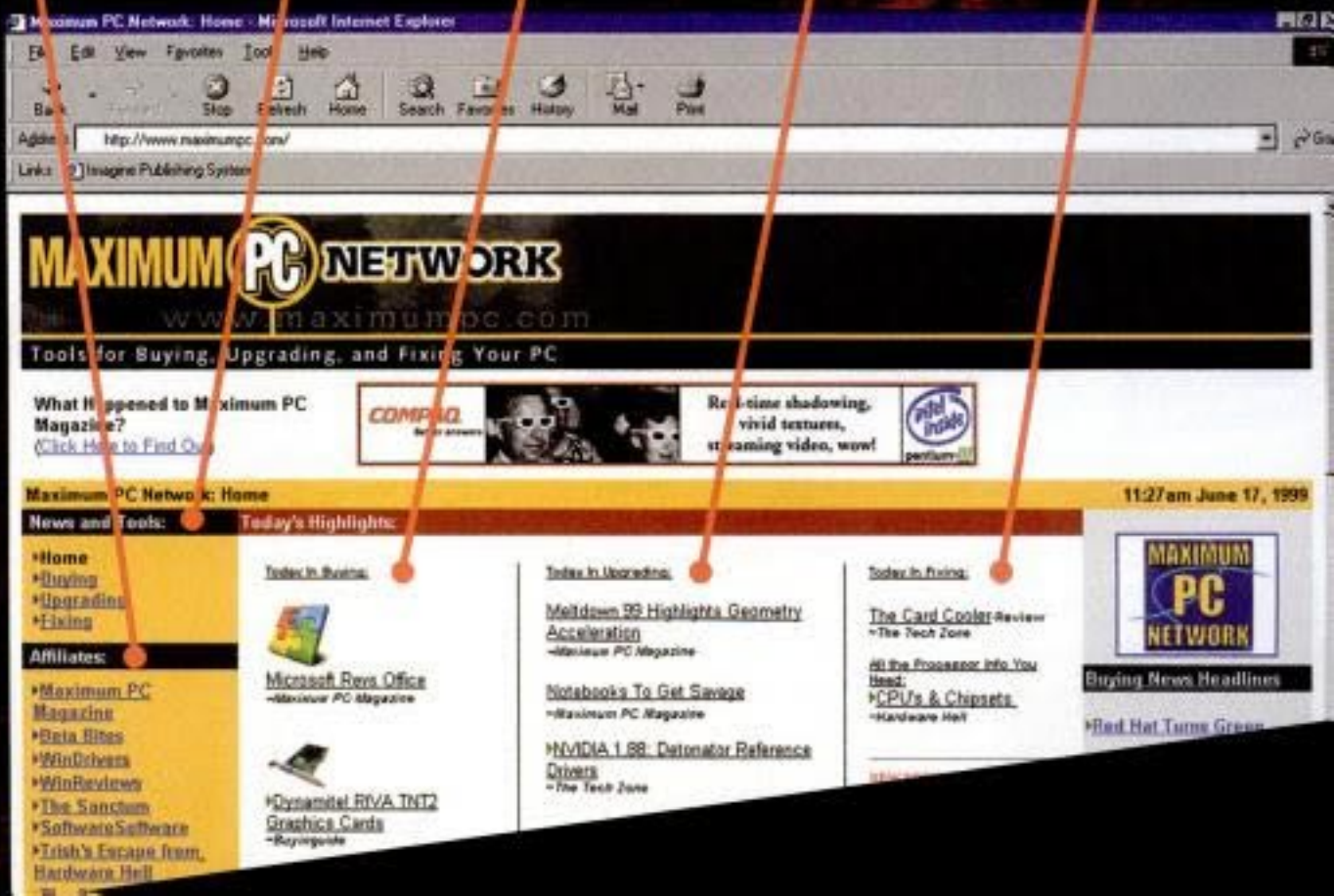

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ASK THE DOCTOR

Formatting highs and lows

My friend believes formatting a hard drive is somehow bad for it (both the standard Format C: and the /Q quick format methods). I disagree. I format my computer all the time and don't have any problems. Who's right?

—Kendall Russell

You're half right, Kendall. High-level formatting (the most common kind) does no physical damage to a hard drive. Whether done via a DOS command or a Windows right-click, high level-formatting copies hidden operating system files to the volume; marks bad sectors as unreadable; writes the boot sector; creates the FAT; and writes the root directory. It doesn't actually wipe the data area of the disk, but since it replaces the FAT that serves as your hard drive's table of contents, the data that still exists on your hard drive can be difficult to find. Though un-formatting utilities are available, recovering missing data after a hard drive format can be as difficult as recovering your dignity after a god-awful haircut.

If you and your friend are arguing over low-level formatting, which erases everything on a drive and rearranges all the tracks and sectors, then your friend is right. Low-level formatting removes corrupted operating systems or viruses, remaps the drive in order to reallocate all bad sectors to other sectors, and erases all traces of data on the disk. Since it fundamentally alters and redefines the landscape of your hard drive platters, manufacturers recommend performing a low-level format once in the drive's lifetime—before it leaves the factory.

In short, regular old formatting—that is, high-level formatting—is fine and won't harm your drive.

> **"Though un-formatting utilities are available, recovering missing data after a hard drive format can be as difficult as recovering your dignity after a god-awful haircut."**

E-mail segregation

Is there a way to set up two ISPs on the same computer, one using *Internet Explorer* and the other *Netscape Communicator*, without conflict in Windows 98? I would also like two different mail accounts, if that isn't asking too much.

—Barry Silverstein

With Windows 98 (or Win95 with Dial Up Networking 1.3 installed), setting up separate dial-up accounts is a painless process. But be careful about getting all of the TCP/IP particulars in the right places. To keep one ISP's settings from trampling on the other's, you must open the properties of each account and enter the respective

Windows can support multiple dial-up network settings as long as you set it up correctly.

DNS and IP (if required) in the respective TCP/IP Settings (under the Server Types tab). Avoid using the network control panel to set up your ISP connection, because it will hardcode the dial-up adapter with one set of TCP/IP settings and override any other setting.

Of course Windows will want to establish one account as the default and use its settings whenever it needs to dial out. In your case, this ISP account should be your *Internet Explorer* connection, since *Communicator* allows you to set up its own default connection and *IE* doesn't. If you want to use the separate mail and newsgroup readers of each browser, you can specify the mail and news accounts separately under each browsers' options menu without a problem. Also, each app will prompt you to choose it as your default e-mail program, so you'll have to make a choice between Microsoft and Netscape as far as who is the boss of whom.

This month:

- Separate but equal e-mail
- We Promise you a Miracle
- Much ado about MTU

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Never promised you a boot drive

I'm planning to purchase a new UltraDMA/66 hard drive and noticed that some of them come bundled with the Promise Ultra66 Accelerator. I'm a little confused—can I boot from the hard drive when it's attached to the Promise controller? How do I make this setup work?

—Bing

Yes, you can boot from a hard drive that's connected to the Promise controller, as we did with the Dream Machine we constructed for this month's feature. Just hook up the bootable hard drive to one of the Ultra66 channels, and change the device boot order in your CMOS setup utility—select from the list shown either the name of the actual physical drive attached to the Ultra66 (Phoenix BIOS), or "SCSI controller" (Award or AMI BIOS). Although the Ultra66 isn't a SCSI controller, many CMOSes assume that any non-motherboard hard drive controller is SCSI, since IDE is built in. If the only hard drive you're using is connected to the Promise controller, it will be identified as the boot drive by default.

If you already have an existing PCI SCSI card in your system, you may need to change the slot position of the card in order to ensure that the system finds the Ultra66 card first. Or, you can disable the SCSI card's BIOS, to keep it from interfering. Instructions for bringing up the SCSI BIOS, if the host adapter contains one, are displayed when the card is being recognized by your computer's BIOS during bootup.

"Can I boot from the hard drive when it's attached to the Promise controller? How do I make this setup work?"

Me and you and MTU

I'm having a problem stemming from the July '99 12-Step—Faster Internet Connections. Step 10 explains how to ping your ISP and find the greatest possible MTU, but the highest MTU I could achieve was 548, using both my 33.6 and my 56.6 modems. My understanding is that the lowest MTU supported through a TCP/IP connection is 576. How did I get 548?

—Phillip Wright

The explanation is complicated. First of all, the Internet uses a collection of protocols—IP, TCP, UDP, SMTP, FTP, ICMP, POP3, etc.—commonly referred to as the TCP/IP suite. The lowest level of the Internet is the Internet Protocol (IP), which in turn has higher level protocols riding on top of it. Each of the various protocols attaches an informational header to each packet it sends. Because the PING command uses the Internet Control Message Protocol (ICMP), it will always respond with a value exactly 28 bytes smaller—20 bytes for the IP header and 8 bytes for the ICMP header—than the value at which your MTU is set.

Don't throw a fit if your PC sees the Promise Ultra66 Accelerator as a SCSI card. Sometimes it's the only way your BIOS can see it.

This is also why the RWIN value noted in Step 10 of the 12-Step is calculated by subtracting 40 from the MTU. These 40 bytes include a 20 byte IP header and a 20 byte TCP header, which were discarded by the TCP/IP stack as the data was put in the Receive Window (RWIN) buffer before acknowledgement. Judging by the response your PING command returned, we can tell that your MTU is currently set to 576. For testing purposes, set your MTU to 2000 and try the PING command again. If it continues to respond with a value of 548 as the highest available packet size, you'll have to be satisfied with the fact that your ISP doesn't support a larger MTU than 576.

This isn't a bad thing if you limit your online time to just web browsing, but if you want to maximize potential bandwidth and knock some heads in multiplayer games, look for an ISP that doesn't clog your connection with extraneous TCP/IP headers. ●

second opinions

Zipped up

In the June '99 Watchdog section, you published a letter from Bruce that stated, "I bought a PC with a Zip drive that wouldn't save more than 31.4MB on a disk." I was in the same situation myself, and was also ready to start hounding Iomega. But first I decided to play around with the files on my disk. That's how I found out that Zip disks suffer from the same limitations as DOS: Since a Zip disk is a FAT volume, it can't have more than x number of files in the root directory (I haven't quite figured out what x is yet).

I discovered this after transferring a few files from the Zip to the desktop, creating a new subdirectory on the Zip, then moving the files back to the Zip. Using subdirectories, I was able to fill the entire 100MB of my Zip disk without any problems. Lesson learned. Explore your software before saying so-and-so company is all screwed up. Believe me, I don't think that all companies are excellent, and this info should have been in Iomega's documentation, but every measure should be taken before ragging on a deficiency that isn't even within a company's control.

—Floyd Clark

Surface Blemishes

I just read your response to Michael in the June '99 issue. He said his Seagate 10.2GB drive had bad sectors. Although he mentioned that he's running Win98, he didn't state which machine and BIOS he was running the drive on. If he's running a system that can only see a large drive by running a drive overlay, such as *EZ Drive*, that lets older systems see larger drives by tricking the BIOS, he could be in trouble. Since the overlay is tricking the BIOS, any surface scan he runs that finds a bad sector and fixes it could be fixing the wrong sector. If he runs Scandisk again, it will see the original bad sector and the "fix" it just made, and will want to fix it again. Run it again and you have four, then eight fixes. See a pattern?

I always suggest to my customers that they never run *Norton* or *Nuts & Bolts* surface scanners. Both programs are fine for testing in labs, but in the long run it's better off to run a standard (not "thorough") Windows Scandisk to check the drive. You can always run checkdisk to fix any crosslinked files and check for bad sectors. If Michael's fairly new drive has bad sectors, he should consider contacting Seagate for an RMA. In my experience, trying to fix bad sectors is like bailing water out of a boat with a hole in it. Don't go down with the ship.

—Trailhed

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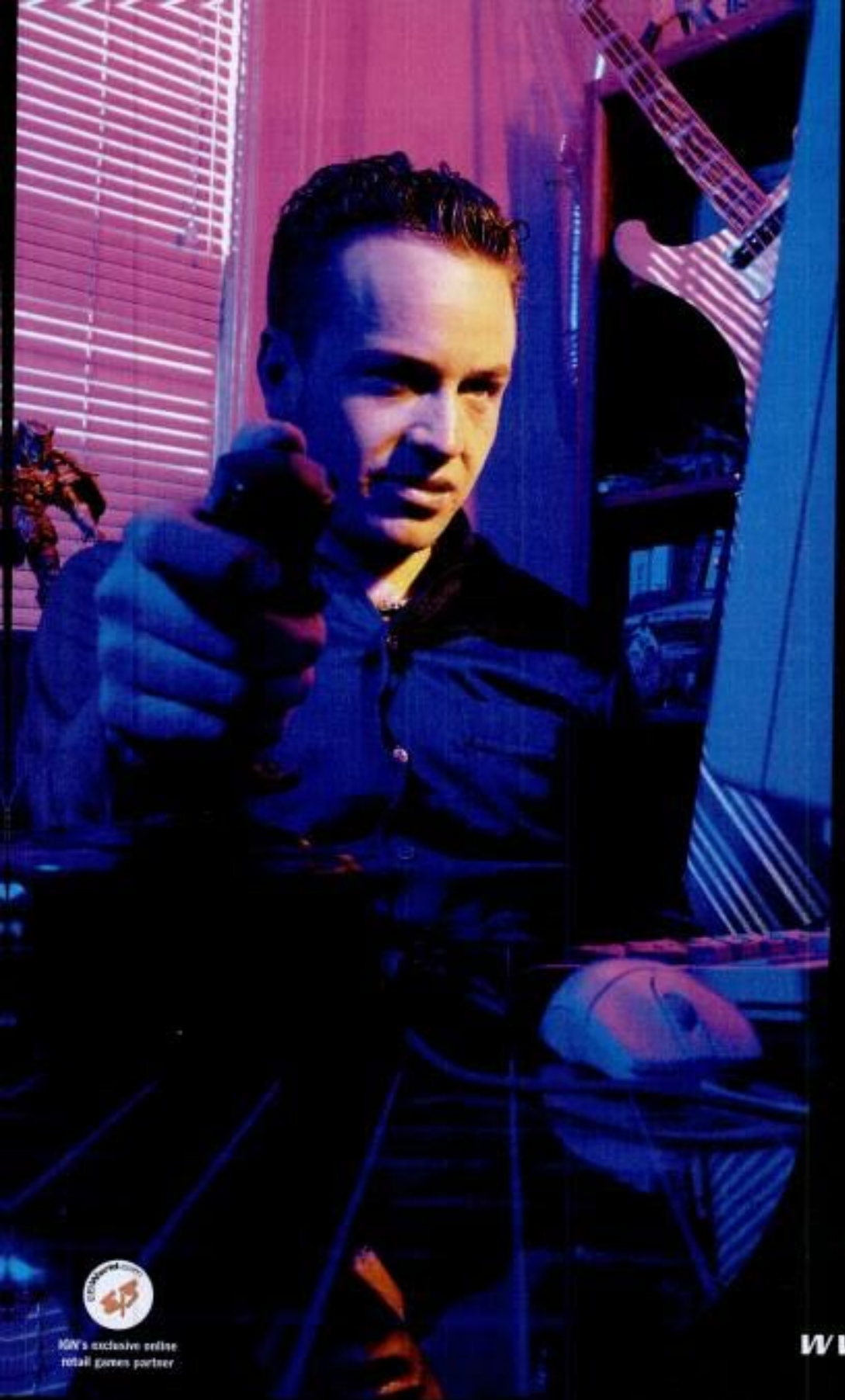

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12-STEP

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The Joy of Benchmarking

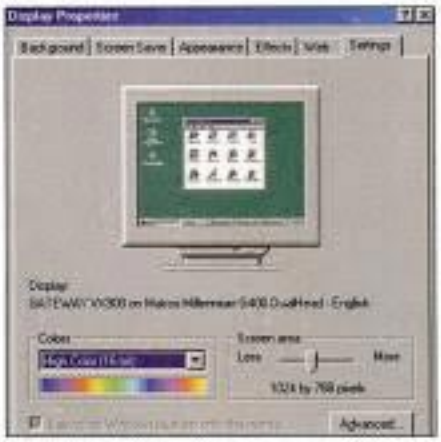
PC manufacturers always boast about their systems' performance. While we'd love to believe their boisterous claims, the fact is that many companies exaggerate. That's why we benchmark. Benchmarking pinpoints the performance of specific components in a machine and provides concrete, indisputable numbers that let us accurately compare one machine to another.

The *Maximum PC* benchmark suite is specifically designed to test a machine's most important components—namely, the processor, chipset, system bus, videocard, hard disk, and CD-ROM subsystems. Here's an insider's look at how we conduct benchmarking in our lab, and what the scores mean when you see them in a system review.

—Rick Popko

1 ALL THINGS CONSIDERED

Before running the benchmarks, we level the playing field by setting the graphic resolution to 1024x768 and 16-bit color. We also turn off Active Desktop, disable the screen saver and power management, and jack the monitor's refresh rate to at least 85Hz. If the monitor can take it, we



prefer running at 100Hz to eliminate any possibility of the refresh rate putting a frame rate cap on our gaming benchmarks. If the system includes a network card, we disable it in the Device Manager, to keep it from grabbing any of the CPU's processing cycles. Although we use the drivers that ship with the machine for our official benchmarks, we also note in the review whether new drivers that boost the PC's performance (especially for the video card) are available.

3 WINDOWS APPS

The first benchmark we run is *SYSmark 98*, since it takes up to five hours to complete. We get this one started about the time we're ready to go home, and let the PC run the *SYSmark* gauntlet overnight.

SYSmark runs action scripts through a suite of real-world content-creation and business-productivity apps, notes how long the scripts take to complete, and spits out a cumulative score based on an abstracted scale. The suite includes a nice mixture of integer- and floating-point-intensive programs, including *Bryce 2*, *CorelDraw 8*, *Netscape 4.05*, *Photoshop 4.01*, *Premiere 4.2*, and *Word 97*. More information can be found at **www.bapco.com**. Although *SYSmark* reports individual scores for every app it runs, we only report the official overall score in our reviews—the higher the number, the better the performance.

2 BOOT UP/SHUT DOWN

The first thing we actually measure is the length of time it takes for a computer to boot up and shut down. We use a stopwatch for this, starting the watch the moment we hit the power button and stopping it when the Windows hourglass cursor turns into its normal arrow. Measuring boot times allow us to monitor how much superfluous crap vendors have put in their startup routines. This junk can include everything from extraneous drivers to useless task schedulers placed in the Startup folder.

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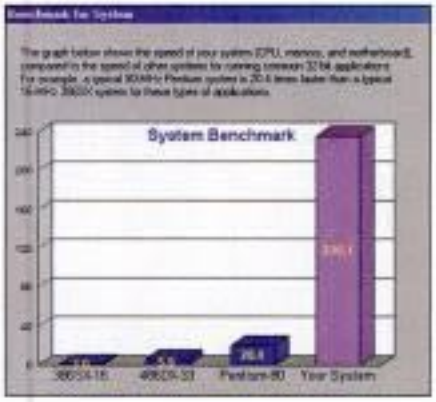
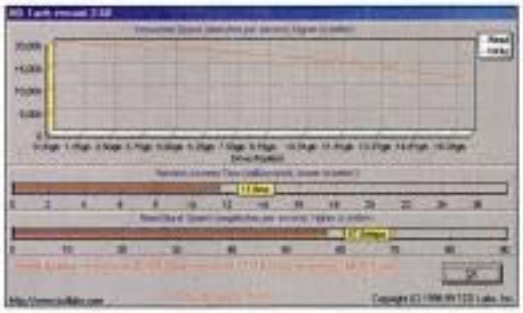
4 CPU/MOTHERBOARD

bootMark is based on Symantec's *System Information* benchmark. It emulates the processing instructions that Windows 32-bit applications commonly use, testing CPU integer performance, L1 and L2 cache, the system's core-logic chipset, and the transfer rate between memory and the CPU. Disk drive and videocard power don't factor into the bootMark equation. We run this benchmark 10 times and publish the highest score achieved.



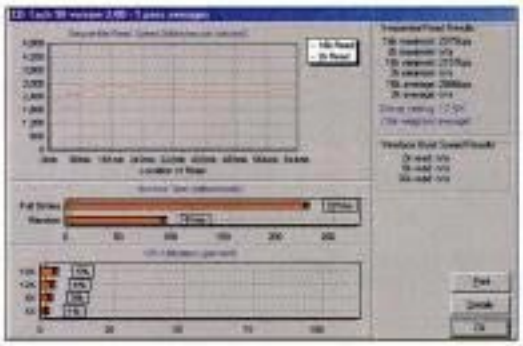
5 HARD DRIVE

HD Tach v2.6, created by TestaLabs, tests a hard drive's sequential read, sequential write, random access, CPU utilization, and burst rate. By bypassing all file system caching, this test is able to evaluate the true performance of the hard drive. The completed test gives us the drive's minimum, maximum, and average read speeds in megabits per second. For the sake of clarity, we then covert the average speed score to megabytes (MB) per second and publish the result.



6 CD-ROM

CD Tach 98, also created by TestaLabs, tests a CD-ROM drive's data-transfer speeds, access times, and CPU utilization. The final performance rating score is derived from the averaged scores of the inner, center, and outer track read speeds. These track scores are generated in multiples of 150K/sec (or 1x). If you do the math, this means that a 12x drive is able to read/transfer 1,800K (12 x 150K) of data per second.



7 3D RENDERING

One of the best ways to test a CPU's floating-point performance is forcing it to render an incredibly complex 3D scene. Rendering anything, be it video or 3D, is probably the most taxing thing you can ask your computer to do. For this particular benchmark, we use NewTek's *Inspire 3D*, the consumer version of its industry leading *Lightwave 3D*. Inspire has a built-in timer

that records how long it takes to render a frame of animation, measured from the time we click the render button to the time the frame is finished. The scene we use, RAYTRACE.LWS, is composed of highly reflective, high-polygon-count balls. It takes darn near forever to render—that is, about five minutes. We run this benchmark three times and publish the system's best time.

8 IMAGE EDITING

We use *Photoshop* to test the CPU and memory bus, and even the hard drive in worst-case scenarios. We begin by importing a 3.7MB image and then apply a handful of real-world actions to it. The actions include image resize, watercolor and patchwork filters, gaussian blur, lens flare, color palette conversion, and image rotation. Using a stopwatch, we record how long it takes *Photoshop* to complete the actions list, then publish the best of three time trials. *Photoshop* uses an intense mixture of integer, MMX, and floating-point instructions, and really exposes a CPU's power. Typically, images are fully loaded into main system memory, but sometimes the test will cache to the hard drive as it wrestles with big chunks of image data.

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9 DIRECT3D

Expendable is the latest explosion-laced action-fest to fatten your eyes with heavy 3D visuals. Requiring DirectX 6.0 and 4MB of video memory to run properly, *Expendable*'s detailed multi-textured environments and lightmapped explosions stress even today's best 3D cards. Expendable also includes a handy timedemo feature that runs through a single level of the game and creates a text document detailing the lowest, highest, and average frame rates. We run the timedemo at 1024x768 in 16-bit color with trilinear filtering and triple buffering turned on and detail level set to high. We publish the best score from two runs of the timedemo.

10 OPENGL

Quake II is the OpenGL standard-bearer, and John Carmack packed his baby with enough advanced visual effects to power an entire generation of 3D shooters. The game stresses the CPU's floating-point abilities and the 3D card's multitexturing prowess. We test with DEMO2.DM2, running the timedemo a good five to ten times until it settles down to one score, which we publish as the official result.

With *Quake III* on the horizon, the *Quake II* benchmark will soon be replaced. As each new test demo is released by id software, we plan to run it as a point of reference on new systems and individual video cards. We will, however, wait until the game is completed before dumping *Quake II* as our OpenGL benchmark.

11 LOOKING AT THE RESULTS

This month we redesigned our benchmark chart in hopes of making it a little easier to understand. The chart at the bottom right is for our base test system, a 500MHz Dell with 128MB of RAM. Using our suite of benchmarks, we tested this Dell machine and used the scores it achieved as the mid-point for our new benchmark chart. Now, any new machine we review will be compared against the Dell system. For example, if a new machine comes in with a CD-ROM that tests at 12x, it will receive a red bar that extends to the left of the midpoint. If the drive tests at 42x, it will receive a green bar that extends to the right of the midpoint.

12 JUSTIFY OUR LOVE

In the end, there's only so much benchmarks can tell us. While they're clearly important when gauging the speed of the machine, they're not the only thing we look at when handing down a final verdict. We also consider the PC's software bundle, peripherals, expansion bays and slots, speakers, case design, monitor, and use of cutting-edge technology. A system with semi-decent benchmarking scores can still get a score of 7 or 8 if it brings a lot of extra value to the table, such as great speakers, a DSL modem, or nearly unlimited hard drive space—but it will never earn a Kick Ass award. On the other hand, awesome scores alone do not a good computer make. Only those system manufacturers that bring both performance and extra value to the table can earn our ultimate respect.

THE BENCHMARKING CHART

Our revamped benchmark chart gives you the down and dirty scores to help you quickly compare the machines we review. The chart consists of eight benchmark tests and score bars, with the zero point on the score bars equating to the benchmark scores of our 500MHz Pentium III Dell test bed system. A green bar means it tested faster than the test bed in that particular benchmark. A red bar means it scored lower than our test bed. If you don't see any bar, then the computer tied.

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TESTING POLICY

Our product evaluation process is built on down-and-dirty, hands-on testing. All hardware benchmarking is conducted in the Maximum PC lab by *Maximum PC* editors, and, whenever possible, we use real-world applications to gauge performance. Our final verdicts, which fall in a scale from 1 to 10, are based on both benchmark results and a subjective appraisal of product features.

EDITOR'S CHOICE AWARD:

Only 9 and 10 verdicts are even eligible for the coveted Kick Ass award, the mark of PC excellence.

CHECK IT OUT online

www.maximumpcmag.com

Online Guide to Benchmarking

You can always go to **www.maximumpcmag.com /benchmarking** for the complete explanation of *Maximum PC*'s benchmarking policies.

How to Read the Benchmarks

Our Dell Dimension test system is used to establish zero points for all desktop benchmarking, and as a test bed for individual component evaluation. The Quantex notebook serves the same purpose for notebook reviews. The base system scores represent the average acceptable performance of high-end machines as of 07/99. We will update the mid-point systems every six months with machines from different OEMs.

DESKTOP ZERO-POINT SYSTEM: Dell Dimension XPS T500: P-III 500MHz, 440BX chipset, 128MB 100MHz SDRAM, 32MB TNT2 videocard, 12.7GB 7200rpm UDMA33 hard drive, 40x (advertised speed) CD-ROM.

NOTEBOOK ZERO-POINT SYSTEM: Quantex I-1410: 366MHz mobile Pentium II, 96MB SDRAM, 8MB ATI Rage LT Pro video chipset, 8GB hard drive, 4x DVD-ROM.

Desktop Systems

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark	228	26	228	430
WINDOWS APPS SYSmark 98 official score	204	96	204	300
HARD DRIVE HD Tach MB/sec	15.1	2.2	15.1	28
CD-ROM CD Tach98 drive rating	26.2x	13.8x	26.2x	40.0x
3D RENDERING Newtek Inspire3D sec	441	562	441	320
IMAGE EDITING Adobe Photoshop 5.0 sec	126	202	126	50
DIRECT3D Expendable fps	53.3	0	53.3	120
OPENGL Quake II v3.20 fps	51.5	0	51.5	120

0

The specific score achieved by the system.

The mid-points denote "acceptable performance" and are based on the precise scores achieved by our base Dell and Quantex systems. As we review new systems each month, their benchmark scores will fall either below or above the mark of acceptable performance.

Notebooks

REAL WORLD BENCHMARKING

CPU/MOTHERBOARD bootMark	171.2	42.4	171.2	300
WINDOWS APPS SYSmark 98 official score	156	87	156	225
HARD DRIVE HD Tach MB/sec	9.7	4.4	9.7	15
CD-ROM CD Tach98 drive rating	12.7x	5.4x	12.7x	20.0x
3D RENDERING Newtek Inspire3D sec	562	804	562	320
IMAGE EDITING Adobe Photoshop 5.0 sec	190	300	190	80
DIRECT3D Expendable 1024x768 fps	12	0	12	24
OPENGL Quake II v3.20 640x480 fps	25	0	25	60
SPREADSHEETS Microsoft Excel 97 sec	172	294	172	50

0

The more a system outperforms the mid-point system, the further into the green its bar moves. The numbers shown at the high-point are the best scores we expect to see in the next six months.

The more a system underperforms the mid-point system, the further into the red its bar moves. The numbers shown at the low-point are the lowest scores we expect to see in any shipping product.

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Component Testing

VIDEO CARDS To gauge video card performance, we measure frames per second (fps) in popular real-world games. *Quake II* is the OpenGL standard-bearer. *Half-Life* is based on the Quake II engine, but uses more detailed models and texture maps. *Expendable* is a Direct3D torture test packed with multi-texturing effects, while *Descent 3*'s indoor/outdoor Fusion engine pushes mucho polygons and colored lighting effects.

MONITORS We use the DisplayMate utility from Sonera (**www.displaymate.com**) to check CRT and LCD monitors for distortion and flaws. When comparing multiple displays for a single review round-up, we run as many of the displays as possible off the same video signal, care of the one-input/six-output Extron P/2 DA6 PLUS VGA splitter (**www.extron.com**).

SOUND CARDS While each sound card review is based on a subjective evaluation of the cards' features, we do measure CPU utilization with Shiny Entertainment's *Performance Tester*, and DirectX 6.2 SDK. We also use a variety of DirectX and OpenGL gaming benchmarks to measure the impact the sound engine has on frame rates.

HARD DRIVES We use the *HD Tach* benchmark from Testa Labs (**www.tcdlabs.com**) to scrutinize average read time, random access time, read burst speed, and CPU utilization. Drives are then pummeled with the Intel *Iometer* in NT and exercised with real data in real-world scenarios (all described in detail in the July 99 issue on pages 56-57).

CD-ROM DRIVES The *CD Tach* benchmark from Testa Labs performs sequential read tests at nine locations on the disc, along with checks of full stroke access time, random access time, and CPU utilization.

DIGITAL VIDEO When evaluating digital video products, we take a digital still of fleshtones in a controlled lighting environment and compare it to stills from previously reviewed cameras. We also film color palettes and black-and-white lines of varying width, to gauge color accuracy and the camera's ability to resolve fine detail.

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REVIEWS

KICKIN' THE TIRES ON THE LATEST HARDWARE AND TAKIN' THE LATEST SOFTWARE OUT FOR A SPIN

Hardware Photography by **AARON LAUER**

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Sony VAIO Digital Studio

STILL NO CIGAR

The Digital Studio's 1394 ports now let you network machines together.

Sony's Digital Studio is to our Kick Ass award what Susan Lucci is to the Emmies: a perennial almost-won. For the third time, the Digital Studio comes just shy of earning the coveted honor.

Sony has completely redesigned the VAIO's case and added a Hitachi 4x DVD that received a 6 verdict in our February 1999 issue, a Sony CD-RW that earned a 9 in May, and extremely fast IEEE 1394 networking. Though we were impressed by Sony's strong networking performance, its lukewarm gaming, hard drive, and DVD scores disappointed us. Still, this latest incarnation packs great value inside its Terminator-style case.

Courtesy of Sony's proprietary SmartConnect drivers, the IEEE 1394 ports are now recognized in Windows 98. Hooking up two Sony network-compliant devices, such as the new PCG-F270 VAIO notebook and another Digital Studio, is now as easy as attaching an iLink cable. We found Sony's connectivity about twice as fast as the 10/100, wireless, phone, and USB solutions in our August 1999 networking feature. It is not, however, faster than 100Mbps Fast Ethernet. While we're happy to finally see a company using 1394 for more than capturing digital video, we're sad the technology currently works only with Sony machines.

Sony has also taken a step toward more expansion. The last Studio we looked at had four PCI slots with one free, while the new system has three PCI (two free) and one 2x AGP. Where the previous generation had only one front internal bay, the new Studio accommodates two.

On the performance tip, the Digital Studio was a mixed bag. When compared to a 500MHz Dell and our Dream Machine (profiled in this month's feature), the Sony took first place in the bootMark, SYSmark, *Inspire*, and *Photoshop* tests, but came in last in HD Tach and CD Tach. And Sony took the worst beating in our gaming benchmarks; the 16MB Rage 128 couldn't compete against a 32MB TNT2. But at least this time, the graphics are card-based and not soldered onto the motherboard. Running *Expendable* at 1024x768, the Digital Studio squeezed out only 17.3fps compared to Dell's 53.3fps and the Dream Machine's 51.1fps. And while its OpenGL performance fared a little better running *Quake II*, the Sony could muster only 37.4fps. We were also surprised by how poorly IBM's 34 GXP 7,200rpm drive fared. It sustained a sluggish 12.6MB/sec across the platters.

Two other notable modifications include a monitor change and enhanced video capture capabilities. The standard purple monitor with crappy built-in speakers was replaced with a vanilla 17-inch monitor and a separate pair of crappy speakers. The realtime video-capture software lets you apply special effects such as sepiatone, fun-house mirror, and wiggle to your incoming video. And after you've captured your video, Sony's software will crunch it down and let you send it to your friends via e-mail.

While it's hard to overlook the Digital Studio's middling hard drive and game performance, we feel its improvements outweigh the strikes against it. With a 32MB videocard and a better DVD drive (perhaps with hardware TV-out?), it would have inched itself into Kick Ass territory.

—Rick Popko

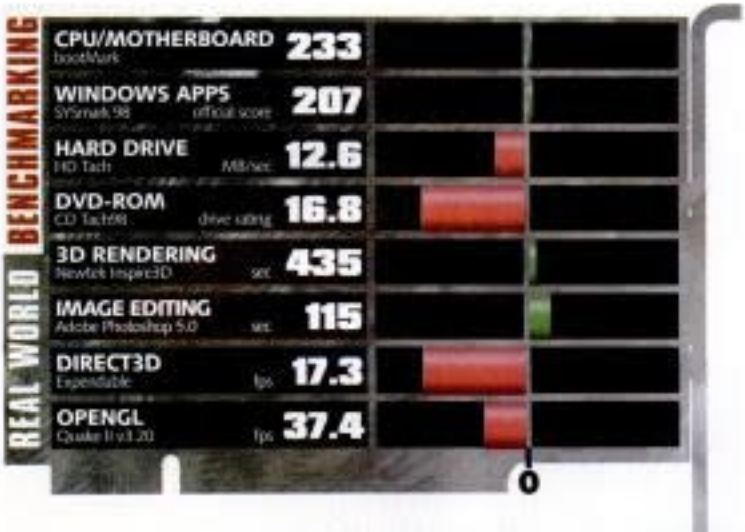
PLUSES
- FireWire networking
- FireWire video capture/editing
- Spacious hard drive
- Cool case design
- Good software bundle

MINUSES
- Middling game performance
- Mediocre hard drive performance
- Limited expansion
- Crappy speakers

UNDER THE HOOD

THE BRAINS	
CPU	Intel Pentium III 500MHz
L2 Cache	512K
RAM	192MB 100MHz SDRAM (192MB max)
Motherboard	Micro ATX
Drive Bays	Two 5.25-inch (none free) Three 3.5-inch (one free)
I/O Ports	Two FireWire, two USB, one serial, one parallel, one MIDI/gameport
DISPLAY	
Video	AGP 2x ATI Rage 128 GL with 16MB SDRAM
Monitor	17-inch Sony Trinitron Multiscan HMD-V200
Res/Refresh	1280x1024 @ 32-bit
STORAGE	
Hard Drive	20GB IBM 34GXP 7,200rpm UDMA/66
CD/DVD	Hitachi GD2500 4x DVD and Sony CRX 100E 24x CD-RW
Removable	Sony CD-RW and floppy
Fax/Modem	LT 56K Win Modem
SOUND	
Sound	Vortex AU8830 on motherboard
Speakers	Sony SRS-Z050V (powered two-piece)
OTHER	
	Scroll wheel mouse, programmable USB keyboard
THE BUNDLE	
	Adobe Premiere LE ▮ Adaptec DirectCD ▮ Adobe PhotoDeluxe Home Edition ▮ DVgate Motion ▮ Lucas Arts Pathways to the Force & Rogue Squadron ▮ McAfee VirusScan ▮ MS Encarta 99 ▮ MS Works ▮ Intuit Quicken

BOOT: 1:07 DOWN: 0:04



MAXIMUM PC VERDICT

Price $2,550 ($350 extra for 17-inch monitor)
Company Sony
Phone 800.571.7669
URL www.sony.com

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EXPANSION NOTES

While they have gone to great lengths to expand the box, making room for two internal device bays and freeing up two PCI slots, Sony engineers should think about growing the system into a full tower with its next release.

EXPANSION MAP

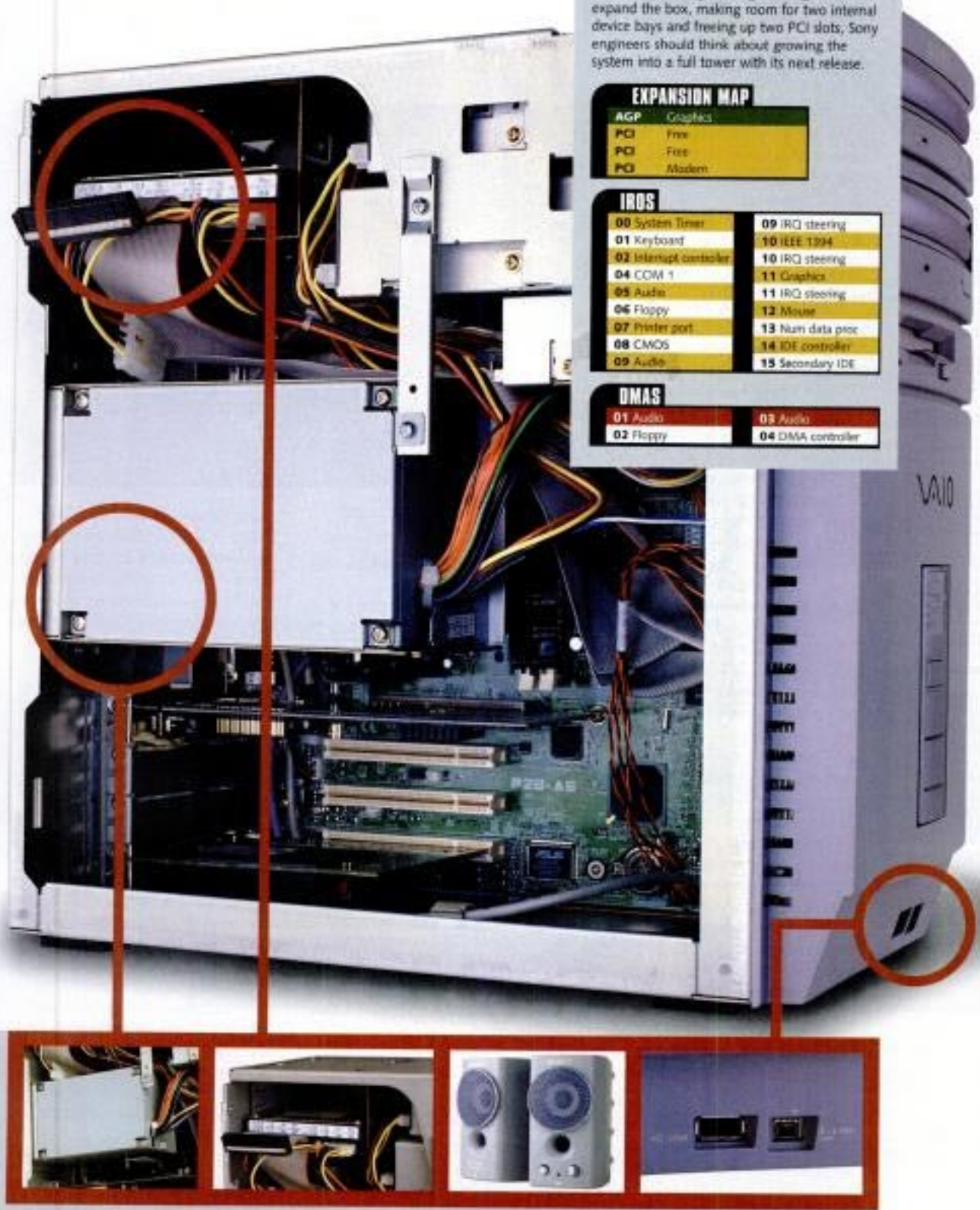
AGP	Graphics
PCI	Free
PCI	Free
PCI	Modem

IRQS

00 System Timer	09 IRQ steering
01 Keyboard	10 IEEE 1394
02 Interrupt controller	10 IRQ steering
04 COM 1	11 Graphics
05 Audio	11 IRQ steering
06 Floppy	12 Mouse
07 Printer port	13 Num data proc
08 CMOS	14 IDE controller
09 Audio	15 Secondary IDE

DMAS

01 Audio	03 Audio
02 Floppy	04 DMA controller



Fight the power To get to the Studio's processor and main system memory, you need to yank out the power supply.

We need our space Expansion junkies aren't going to find a lot of room to grow in this little guy. The bay you see here is the only free one in the machine.

Sound advice Sony's two-piece satellite speakers stink to high heaven. Period. They don't even include a sub jack.

Welcome to the 1394 network With the ability to transfer roughly 2MB of data per second, the Studio's 1394 network capabilities are twice as fast as a standard 10/100 Ethernet card.

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Descent 3

GOING DOWN FOR THE THIRD TIME

Descent's debut in 1995 marked the birth of the 360-degree shooter genre. Four years later, it's good to see that the stomach-churning saga is still alive and kicking.

Descent 3 flies you back into the mines to search for the virus infecting PTMC's mining robots. While the overall story is about as compelling as an episode of "Mama's Family," the action from mission to mission is rapid fire. Unlike the repetitive find-the-key, find-the-door scenarios used excessively in *Descent 2*, this three-quel's missions vary widely, ranging from finding lost colleagues to defending strategic structures against enemy assaults.

Beyond the facelift, *Descent 3*'s bevy of technical improvements include enhanced AI and a new dual 3D-engine technology dubbed Fusion. The improved lighting is especially awesome—a flare fired at a dark wall kicks out radiant spark particle trails that illuminate the impact area with a pulsating glow. The EAX, A3D, and DirectSound are key, since you'll need your ears to track enemy attackers that advance from every angle.

The enhanced AI isn't mindblowing, but it does allow enemy ships to retreat, regroup, and generally try to dodge your every move.

The game's engine has been rebuilt from the ground up, allowing for specular lighting, volumetric fogging, particle effects, and the ability to fly indoors and out. In spite of this, outdoor performance is piss-poor; while it appears as though you can fly anywhere, an invisible ceiling limits your altitude and unseen walls keep you inside the game's boundaries. Even worse, crappy exterior texture maps undulate as they come into view, and in one instance, the texture seams of a valley were visible from all the way across the map. *D3* supports Glide, Direct3D, and OpenGL, but the OGL implementation is pretty damn anemic. We played using a new 3dfx Voodoo^3 3000 with Glide and an older STB Velocity 4400 TNT with Direct3D, and we found no noticeable performance differences between the two cards. At 800x600, we averaged 30fps during intense battles and 50fps in calmer conditions. Cranking it up to 1024x768 begets herky-jerky performance on lower-end machines.

Out of the box, *Descent 3* is multiplayer ready and sports deathmatch, capture-the-flag, and co-op options. Connecting to Parallox's online service was a snap, and with five people in a room blasting the crap out of each other, we encountered no performance lag.

Our biggest disappointment was Outrage's decision to ship without 32-bit textures. The game *does* render in 32-bit color, but according to Interplay, selecting the 32-bit option on the setup menu results only in increased bilinear filtering and fogging.

Despite a few glitches, *Descent 3* rocks. If you're a shooter fan looking for fast-paced, first-person action, *D3* delivers the goods.

—Josh Norem

Descent 3 yanks you off the ground and turns you every which way but loose.

Enhanced AI allows enemies to attack in groups.

Enemy bots fight as mean as they look.

THE SPECS

3D CARD SUPPORT
Glide
OpenGL
Direct3D
3D SOUND SUPPORT
A3D
EAX
DirectSound3D
Dolby Surround
INPUT SUPPORT
Force feedback
Mouse look
DirectInput
MULTIPLAYER
TCP/IP
LAN
Modem
Direct/serial
NO OF PLAYERS
16

PLUSES

- Excellent indoor graphics
- Superb lighting
- Dynamic music adds atmosphere-o-plenty
- Guidebot is very useful

MINUSES

- Visible texture seams in outdoor levels
- FMV animation looks like claymation
- Easy to get lost in the game

MULTIPLAYER TWEAK

Descent 3 is beautiful, and when you're playing by yourself you'll want the highest visual quality. But when it comes to multiplayer fragging, it's best to sacrifice visual quality for speed. Here are a couple of pointers for eeking out those extra few frames.

Sound. EAX, A3D, and DirectSound are great for single-player but can be costly in multiplayer. For peak performance, go with software sound instead.

Visual Effects. While effects make the game look great in single-player mode, they'll cost you plenty on the multiplayer battlefield. It's best to turn these guys off.

Cockpit. Pressing F3 raises the cockpit POV, good for a few frames per sec.

RAM. If you're playing the game with minimal RAM, typing -lowmem or -superlowmem at the command line reduces the game's texture sizes.

MAXIMUM PC VERDICT

Price $50
Developer Outrage Entertainment
Publisher Interplay
Phone 949.553.6678
URL www.interplay.com

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Matrox Millennium G400 MAX

LOVE AFFAIR IN RGB

If loving the Millennium G400 MAX is wrong, we don't want to be right. It puts out the best visuals that have ever dazzled our peepers.

This may sound superficial, but we're lusting big-time after the Millennium G400 MAX—it's so drop-dead gorgeous. Maybe we should respect the MAX for its intelligence or strength of character, but watching it run the *Quake III* test with all the visuals cranked gave us, well, a funny feeling below the belt. The card's crisp display and rich color support show off image details and texture variations that you just don't see with other cards.

But don't think this is just a one-night affair. Every little thing the MAX does is magic, especially when it comes to high resolutions and high color depths. The G400's überfast 360MHz RAMDAC muscles resolutions up to 2048x1536; its DualBus architecture slams pixel data through two independent 128-bit pipelines as fast as fast can. If playing *Unreal* in 32-bit color at 1280x1024 doesn't pup your tent, how about a highly playable 70fps in *Forsaken* running at 1600x1200? Yeah, baby! Yeah!

In our benchmarks, the MAX kept up with the Viper V770 Ultra and the Voodoo^3 3000 in all but *Half-Life*; its intense texture-management requirements bogged down Matrox's still-wet-behind-the-ears OpenGL ICD. Still, Matrox complements the MAX's arousing high-res visuals with a 16- or 32-bit z-buffer with an 8-bit stencil buffer, and single-cycle multitexturing through a new 3D Rendering Array Processor. The G400 is the first chipset that does environment-mapped bump-mapping in a single pass—currently the most impressive way to bring tactile details to texture maps.

Environment-mapped bump-mapping increases surface detail through an extra "bump" layer that works like an environment map, adding details such as grains and grooves to a texture. All the height, depth, and lighting calculations are done to the bump layer on a per-pixel basis. Environment-mapped bumps don't look funny when viewed from different angles, and the additional details aren't distorted when multiple light sources hit them. For texture maps you can almost reach out and touch, this is the way to go.

Doubling the MAX's RGB pleasures is an innovative new feature dubbed DualHead, which supports independent output to two displays. Matrox pulls this off by including two separate CRT controllers; each fetches display data independently from different locations in the frame buffer or directly from AGP memory. In conjunction with Win98's multiple display support, DualHead extends your desktop view across two monitors. You can even select a portion of the screen on one monitor and zoom in to view that section on the other monitor. And you can kick DVD movies out to a TV without dropping your monitor's resolution and refresh rate.

Although there aren't many games that support environment-mapped bump-mapping and no-dual monitor games have been officially announced, we look forward to the day when we can take full advantage of all the G400 has to offer.

—Sean Downey

PLUSES
- Cutting-edge speed and razor-sharp visuals
- Environment-mapped bump-mapping
- Independent dual-display capability
- Excellent DVD playback

MINUSES
- Weak Half-Life performance, care of beta OpenGL ICD

THE SPECS

CLOCK SPEED	166MHz bus / 200MHz memory
RAMDAC	360MHz
AGP SUPPORT	Full 2x/4x
LOCAL MEMORY	32MB SGRAM
MAX 32-BIT RESOLUTION	2048x1536
MAX 16-BIT RESOLUTION	2048x1536
MAX 1600X1200 REFRESH RATE	97MHz
BUNDLE	Win9x/NT drivers | Picture Publisher 8 and Simply 3D 3 | Matrox Software DVD Player | PointCast Network | Expendable

REAL WORLD BENCHMARKING
QUAKE II 1024x768 fps 70.7
HALF-LIFE 800x600 fps 29.1
EXPENDABLE 1024x768 fps 50.7
DESCENT 3 800x600 fps 53.1

Tests run with version 1.11.012 of the Matrox drivers and an alpha version of the 5.20 OpenGL ICD. K6 benchmarks are posted online. As always, V-sync is enabled.

MAXIMUM PC VERDICT

Price $280
Company Matrox
Phone 800.361.1408
URL www.matrox.com

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CHECK IT OUT Online
www.maximumpcmag.com
Web Photo Gallery of *Maximum PC* spies in Re:Print.

Photoshop 5.5

GO WEB, YOUNG MAN

Photoshop is undeniably the most powerful image-editing tool west of print production, and the latest version just rode into town. In addition to a host of web-related loot, including Save for Web and automated web photo galleries, *Photoshop* now ships with *ImageReady 2.0*, an animation and web effects app. While the added integration will make site designers' spurs jangle, *Photoshop* faithful will also appreciate more mighty masking tools, an Art History brush, and flexible type options.

THE SPECS

WEB FORMATS
GIF, JPEG, PNG-8, PNG-24

REQUIREMENTS
Win95/98/NT 4.0 or later
64 MB RAM
125 MB HD space
256-color (8-bit) display

PLUSES
- Lossy GIF
- LiveView Web exports
- Fabulous masking tools
- Revert is undoable
- PDF 1.3 support
- Ships with ImageReady 2.0

MINUSES
- Ships with ImageReady 2.0
- Masking tools learning curve

The new Save for Web feature includes a LiveView window that lets you preview up to four compression methods. It then exports the best option, leaving your original work untouched. Besides comparing JPEG, GIF, and PNG options, the LiveView panels can simulate different viewing environments, such as standard Mac or PC monitor gammas and browser dithering. If you enable the Optimize for File Size function, it will automatically indicate whether JPEG or GIF is the better format. And the new lossy GIF format compresses GIFs by as much as 50% with negligible quality loss. Our only complaints here are that the simulations affect just the panel you select—you can't compare "Standard Windows Color" on all four panels at once—and there's no way to export only a portion of the image you're working on.

Photographers and artists of all shooting levels can quickly sling their own web photo galleries without leaving *Photoshop*. By selecting Automate > Web Photo Gallery and then a folder of image files, you can generate thumbnail-sized JPEGs, large JPEGs, captions, and clean HTML to hold it all together. You can also create Contact Sheets or Picture Packages—multiple sizes of the same image on one sheet—before the sun sets.

Photoshop 5.5 adds a bounty of Save for Web features, including lossy GIF.

Photoshop's fabulous masking tools—Magic Eraser, Background Eraser, and Extract Image—quickly locate an object's edge, erasing colors defined as "background" while protecting those defined as "foreground." These tools take some getting used to, but they're absolutely astounding, and acres better than similar third-party plug-ins.

Masking tools make edge pixels semi-transparent to blend into new backgrounds without splitting hairs.

Version 5.5 also boasts new layer effects, and an Art History brush with ten painter effects. You control the brushstrokes and it's really quick on the draw, but the effects could quickly become cliché if not kept under your lasso. More type options are also available—type can now fake bold or italic and have fractional widths. You can also control the anti-alias style of the type, although we failed to see much difference in the end results between "crisp" and "strong."

A few things we wish this sharpshooter was toting are better selection to clipping-path conversion and a way to numerically rotate, move, or modify selections from the info palette that gives x/y coordinates but won't allow you to change them. Maybe 6.0?

In spite of this, *Photoshop* 5.5 is one upgrade we'd like to call "pardner."

—Sherry Monarko

MAXIMUM PC VERDICT

Price $609, $199 upgrade from 5.0 or ImageReady 1.0
Company Adobe
Phone 408.536.6000
URL www.adobe.com

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IMAGEREADY 2.0: HOPE YOU LIKE LAYERS

It took 27 layers to achieve in ImageReady what Fireworks could do in two.

For advanced web-wrangling, such as imagemaps and animation, *ImageReady* now ships with *Photoshop*. It's well integrated, sharing tools, effects, filters, and a "Jump To" feature for smooth transitions between programs.

Image slicing is easy. You can promote program-generated slices into "User Slices" and define them with rollovers, links, and other behaviors. The default actions palette has interesting animations such as spin and zoom, and the animation palette can auto-generate tween frames. Very cool.

But compared with Macromedia's *Fireworks*, creating rollovers with *ImageReady* is cumbersome; you add layers and frames rather than manipulating frames. Text needs its own layer to be editable, which becomes a nightmare as buttons are added, especially if they rollover. *Fireworks* objects and type are always editable and can live on one layer in harmony.

ImageReady has no swap-image support, a standard *Fireworks* feature. Image-mapping can't be used in conjuction with slices that have links or rollovers, and requires yet more layers. And the JavaScript generated doesn't preload images for rollovers.

Though the drawing tools leverage the familiarity of *Photoshop*, *ImageReady*'s web tools just aren't as complete or user-friendly. We prefer the object-oriented *Fireworks*.

MAXIMUM PC VERDICT

Price Ships with Photoshop 5.5
Company Adobe
Phone 408.536.6000
URL www.adobe.com

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Adobe GoLive 4.0

ADD SOME LIFE TO YOUR WEB PAGES

Your web site just lies there, like a limp dishrag, because your dull-as-dirt HTML editor can't cut it anymore. The solution? An industrial-strength web site layout program. Windows users rejoice, you have a new option: *GoLive 4.0*. In addition to the usual fare found in top design programs, *GoLive* dishes up some cool features you won't find anywhere else.

At first glance, *GoLive* looks and feels like a Mac program; nearly all the available layout elements, built-in HTML tags, and JavaScript actions can be applied by dragging and dropping icons from a multifunction palette. Without writing a single line of HTML code, you can create full-blown sites containing state-of-the-art multimedia, though *GoLive* also accommdates hand-written and editable HTML.

You can drag and drop page elements onto GoLive's layout window and position them with pixel-perfect precision.

For those with a flair for design who envision a unique-looking site instead of a cookie-cutter mish-mash, *GoLive*'s tools are a cut above. Rather than forcing you to work within staid style templates, *GoLive* provides design and scripting tools that guide you in constructing original layouts.

THE SPECS

FORMATS SUPPORTED
WYSIWYG | CSS | Dynamic HTML | JavaScript | QuickTime | XML

PLUSES
- Drag-and-drop interface
- Integrated QuickTime video editor
- Supports CSS, DHTML, XML, and ASP
- 14 powerful JavaScript actions
- Built-in FTP program

MINUSES
- No pre-designed style templates
- Some features are Mac only

The program supports standard 4.0-level browser features such as Cascading Style Sheets and Dynamic HTML, as well as leading-edge technologies such as QuickTime video, Extensible Markup Language, and Active Server Pages. The QuickTime support is especially impressive—within its full-featured video editor, you can add special effects such as gradient wipes, film noise filters, and HREF tracks. If you're considering web-based video, *GoLive* is the undisputed champ for preparing and embedding video files.

The outline view collapses your HTML code into a manageable length, and it even includes a visual representation of your graphics files.

GoLive boasts a long list of tools, options, and shortcuts that will appeal to both professional and casual webmasters. High-level web hot shots will drool over the program's pixel-precise accuracy, integrated JavaScript editor, multiple-cell selection and formatting ability (for quick tables), cross-platform support (PC and Mac), PDF integration, site map printing, automatic link updating (including links for QuickTime, Shockwave, and Flash files), and collapsible HTML outline view. Casual creators will get giddy over the ability to resize graphics, the point-and-shoot tool (for easy links and rollover buttons), and the built-in FTP program (for incremental updates). All will appreciate the 14 pre-programmed JavaScript actions that let you add password protection, create slide shows, set cookies, read values from forms, force frames, and trigger actions on a page.

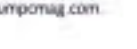
GoLive's biggest drawback for Windows users is its Mac-centric view of the web. It supports only QuickTime video files, even though RealMedia and Windows Media Player files are more common. And Windows users don't get much use out of the AppleScript, ColorSync, and WebObjects support.

Adobe *GoLive 4.0* has what it takes to swing in the ring with the big boys—it goes toe-to-toe with competing programs without blinking. Best of all, *GoLive*'s standout features are wrapped in an easy-to-use and powerful package, making it a real contender.

—David English

MAXIMUM PC VERDICT

Price $299
Company Adobe
Phone 800.685.3612
URL www.adobe.com



CREATE A VIDEO EFFECT

With Adobe *GoLive 4.0*, you can edit web-based video files without leaving the program. Here's how to add a fire effect to a QuickTime file.

- Drag the "Filter Track" icon from the Palette window and drop it onto an empty track on the Timeline Editor.

- Select the new track by clicking on it.
- Click the "Effect" tab on the Video Effect Track Inspector. Click the "New" button to bring up the "Select Effect" dialog box. Click on "Fire" for the fire effect, and click "OK" to select it.

- Click the "Basic" tab, and select the "Straight Alpha" graphics mode. Click the "Play" button on the QuickTime movie window to see the applied effect.

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CorelDraw 9 Graphics Suite

ONE SMALL STEP FOR ARTISTS

Over the years, *CorelDraw* has metamorphosed from a loose collection of low-end graphics apps into a premier tool for intermediate and professional graphic designers. Its latest iteration comes with a host of welcome tweaks and enhancements, but don't look for radical improvements in functionality—most of the enhancements are small and incremental. *CorelDraw 9* and its companion, *Corel Photo-Paint 9*, offer all the latest tools for illustration, such as job ticketing, but some elements could stand more time in the oven.

Granted, there are plenty of new features to like: Both *CorelDraw 9* and *Photo-Paint 9* allow simultaneous work with multiple color palettes (such as the Pantone palette used by graphics pros), a real boon when you're trying to create a single graphic for multiple media. And like Corel's *WordPerfect Office 2000* suite, both applications can export files in PDF format, so anyone with the free Adobe *Acrobat Reader* can view and print your work just as it was intended to be seen. *Photo-Paint 9* and *CorelDraw 9* also sport a host of new filters that simulate effects such as watercolors, crayon, and stained glass.

Both CorelDraw and Photo-Paint allow you to save creations to Adobe's Acrobat PDF format.

THE SPECS

SUPPORTED FILE FORMATS

CDR | PAT | CDT | CMX | AI | PS | PRN | EPS | WPG | WMF | *EMF* | CGM | PDF | HTM | PCT | DXF | DWG | PLT | VSD | CMX | CPX | CDX

PLUSES

- Tons of tweaks and improvements
- Easily saves to Adobe PDF format
- Job ticketing allows for annotation of files

MINUSES

- Convenient roll-up palettes have been 86'd
- Lacks some basic web features
- 3D app CorelDream was dropped

The newly added Object Sprayer quickly adds both bitmap and vector objects to a drawing, a handy-dandy feature for users who frequently work with bitmapped images. You'll also appreciate the ability to link external images and crop them in place. *CorelDraw 9* also includes Microsoft *Visual Basic for Applications 6*, so you can use Visual Basic to enhance *CorelDraw* features.

CorelDraw 9 has given a face-lift to some of its older features. The improved Prepare For Service Bureau wizard can now automatically gather all files associated with a document (including fonts and linked images). The Natural Drawing tool, revamped and renamed the Natural Media tool, flaunts new features, including drawing modes such as Preset, Pressure-Sensitive, Calligraphic, and Brush.

CorelDraw lets you maximize screen real estate by placing toolbars and palettes anywhere you want them.

Even with the new features and enhancements, *CorelDraw 9* and *Photo-Paint 9* could use another once-over. While both apps' interfaces have been streamlined, Corel inexplicably did away with the convenient, space-saving roll-up palettes. Most settings are now accessed through the Property Bar via bulky palettes that can be hooked together, parked around the screen perimeter, or individually pulled into the workspace—but the expanded dockers are cumbersome, and they merge if placed too close to each other. We spent so much time separating them, it started to feel like babysitting our younger brothers. *CorelDraw* also now requires that all pages in a document have the same properties, making it unnecessarily difficult to create multipage output. Some basic web features, such as support for Flash animations, are conspicuously missing. And Corel dropped its 3D application, *CorelDream*, from this version; while it was nothing to write home about, we would rather have seen Corel improve it than kill it altogether.

Despite its shortcomings, the latest version of *CorelDraw Suite* offers plenty of appreciated features and facets, and is definitely worth the upgrade for graphics pros.

—Shane Mooney

MAXIMUM PC VERDICT

Price $695; upgrade $199
Company Corel Corp.
Phone 800.772.6735
URL www.corel.com

8

PDF PUBLISHING

One of CorelDraw 9's great features is that it gives you the ability to publish in PDF (Portable Document Format), which can be read on a variety of computers regardless of their operating systems. Prepare for Service Bureau lets you create a PDF document as a soft proof that the Service Bureau can use as a comparison.

Under Publish to PDF, you have several options: How much of the document do you wish to export? Do you want to include a job ticket that contains production details for each job, such as setup, binding, and delivery information?

After selecting the publishing style, such as Document Distribution, Prepress, or Web, you can view the document with the *Adobe Acrobat* Reader. If you embed your fonts (always recommended), the document will look exactly as you intended.

The final result is interactive. When you click on the web address in the PDF document, it instantly takes you to the appropriate web page.

Copyrighted material

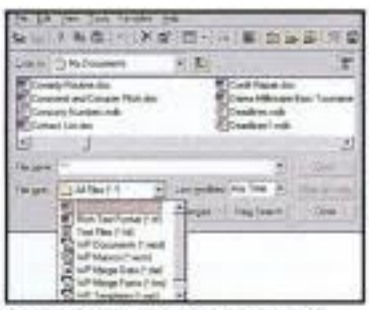
WordPerfect Office 2000

INEXPENSIVE MICROSOFT ALTERNATIVE

Long before Microsoft was a dirty word, *WordPerfect* was king of the word-processing mountain. But in this New World Order, *Word* is the word and Microsoft *Office* is the de facto standard—forcing the suite called *WordPerfect Office* to be happy with second place. Despite many solid improvements, this year's version is no exception.

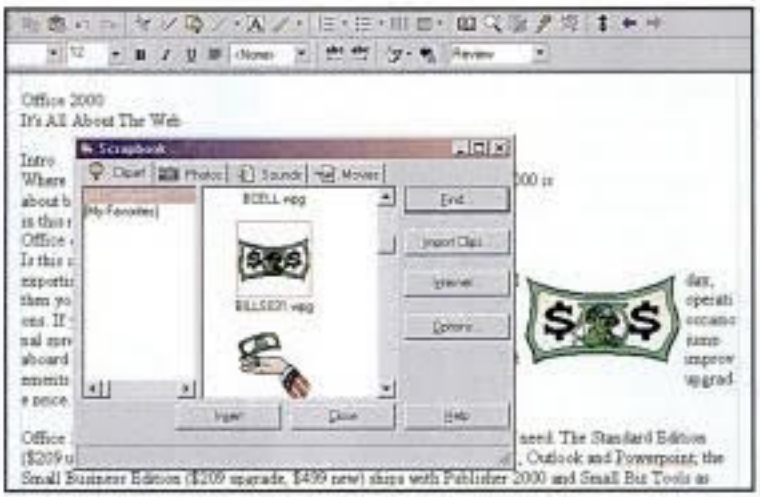
Like Microsoft *Office*, *WordPerfect Office* boasts web integration. Using *Trellix 2.1*, the suite's web-publishing app, you can publish HTML docs from *WordPerfect*, from the spreadsheet program *Quattro Pro*, and from *Presentations*, a *PowerPoint* challenger. The Professional Edition includes Java-based tools you can use to design Paradox forms for web pages. You can even save *WordPerfect* and *Presentations* documents as PDF files—no need for *Acrobat*. However, *WordPerfect*'s lack of a true web-design tool renders its web savvy incomplete.

But the suite does offer other bonuses. *WordPerfect*, *Quattro Pro*, and *Presentations* all include a real-time preview function that reformats a file on screen as you finagle with fonts, colors, or other graphics features. An install-as-you-go



WordPerfect handles Word documents (Word 6.0 and above) almost perfectly, opening and saving without making you reach for an Import/Export command.

WordPerfect Office can easily convert files into web documents.



WordPerfect Office 2000's redesigned graphics scrapbook lets you easily insert images, sounds, and videos from on-disk catalogs or the web.

feature lets you access the scrapbook and other nonessentials as needed. Dragon *NaturallySpeaking* software offers voice-controlled navigation on par with most voice-activated software.

WordPerfect is still an excellent word processor, and this year's edition has many perks. AutoScroll enables quick movement through your document; Block MakeItFit forces a block of data onto a specific number of pages; browser-style Next and Previous buttons (like those in Microsoft *Word*) jump between pages, tables, graphics, and headers. *WordPerfect* actually surpasses *Word* in its handling of multiple formats within the same document, complex multichapter documents, and booklet-style layouts. But *WordPerfect* still can't search for and replace font attributes, forcing you to write macros.

Quattro Pro's new features include SpeedFunctions, for entering functions from the toolbar, and Formula Tips, which guide you through the process of popping variables into place. Other improvements will be embraced by casual users, but for power users, *Quattro Pro* still falls short of *Excel*. Its new Dynamic CrossTabs reporting tool is similar to *Excel*'s popular PivotTables, but the feature lacks *Excel*'s dynamic web skills and is weighed down with an awkward series of dialog boxes.

WordPerfect Office's other apps, while adequate, fall short of those offered by its main rival. *CorelCentral* boasts several useful features, such as a DayPlanner that appears at boot up, but it isn't well integrated with the rest of the suite's applications. *Paradox 9* offers a friendly interface, but is a far cry from *Approach* or *Access* in terms of ease of use. And while *Presentations* has improved imaging tools that let you add special effects to your presentation, and a redesigned Internet publisher that helps you convert your presentation for use on the web, it's still just functional, not wonderful.

Make no mistake—this is an excellent suite of office products ideally suited to SOHO users. It can't compete with *Office 2000*, but for the faithful *WordPerfect* or *Lotus Suite* user on a tight budget, there's plenty of bang for your buck.

—Shane Mooney

PLUSES

- Easiest office suite to use
- Solid web integration
- Fully compatible with Microsoft Word
- Relatively inexpensive Microsoft alternative

MINUSES

- CorelCentral is a pretty sad PIM
- Corel Presentations is unspectacular
- Paradox lacks competitors' ease of use
- Quattro Pro not strong enough for power users and big businesses

FEATURES

STANDARD EDITION
WordPerfect 9, Quattro Pro 9, Presentations 9, CorelCentral 9, Desktop Application Director toolbar, Trellix 2, Microsoft Visual Basic for Applications

VOICE-POWERED
The above plus Dragon NaturallySpeaking 3.0 and Corel Print Office

PROFESSIONAL
All the above plus Paradox 9 and NetPerfect

MAXIMUM PC VERDICT

Price Standard Edition: $400, $110 upgrade; Voice-Powered Edition: $450, $160 upgrade; Professional Edition: $500, $210 upgrade
Company Corel Corp.
Phone 800.772.6735
URL www.corel.com

7

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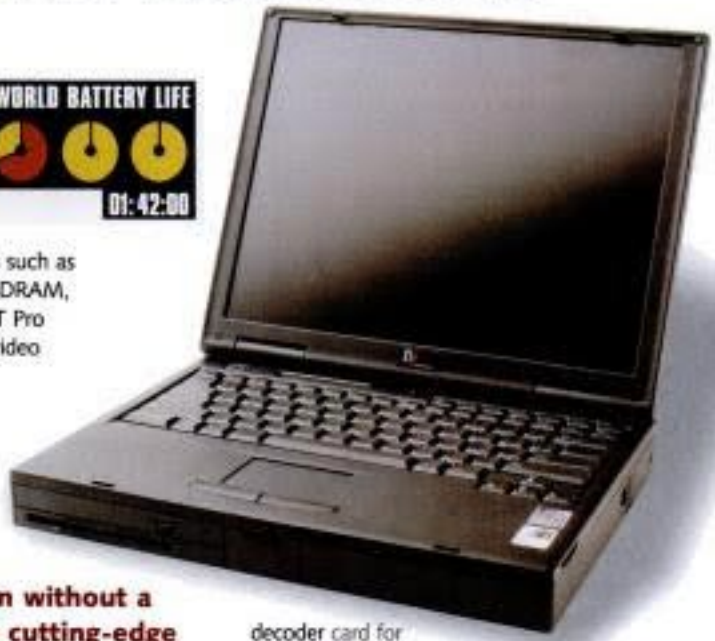
Quantex I-1410 Notebook

A BENCHMARK BREAKER



The I-1410 goes where no notebook has gone before, at least not during *Maximum PC*'s lifespan: It set new records in more than half of our performance-pounding benchmarks. Hail to the new chief.

Despite the inclusion of technology staples such as Intel's mobile 366MHz Pentium II, 96MB of SDRAM, and ATI's ever-present Rage LT Pro graphic chipset with 8MB of video memory, the I-1410 busted benchmarks across a slew of subsystems—there's something to be said for engineering ingenuity. The I-1410 pushed 25fps at 640x480 and decimated previous records in the *GLQuake* performance test. It blew through the bootMark test of integer and L1 and L2 cache performance. And it annihilated the *Inspire* 3D rendering test that taxes the processor's FPU capabilities. Zoinks!

Even without a few cutting-edge technologies, the I-1410's overall system performance and features pull it ahead of the pack.

If benchmarks aren't enough to convince you of its excellence, consider the I-1410's top-notch components: killer sidemounted speakers that produce a robust, near surround-sound experience; a combo 4x Matsushita DVD-ROM and floppy drive; wavetable audio; and a built-in 56K modem. The I-1410 also incorporates LuxSonor's MPEG-2 decoder card for hardware-assisted DVD playback—combined with the DVD-ROM drive and brightly-lit, 14.1-inch active-matrix screen, it makes movie-watching awesome.

We were so impressed with the I-1410 that, starting next issue, all other notebooks we review will be measured against it. We also included our two newest benchmarks: Our improved *Photoshop* test performs color conversions and applies filters, and the *Expendable* timedemo replaces *Forsaken* as our Direct3D test. When comparing the I-1410's benchmarks to those of notebooks we've reviewed in previous issues of *Maximum PC*, keep these changes in mind.

For kicks we checked the I-1410's Photoshop performance against Gateway's new 550MHz Pentium III-powered desktop system and were shocked that the I-1410 took only one minute more.

The only place the I-1410 faltered was in sleep mode; more than 80% of the time, it refused to wake up when prompted, forcing us to pop out the battery for a cold reboot. And the CD-ROM performance of the 4x DVD-ROM drive was the slowest we've seen all year.

With a carrying weight in excess of 9 pounds and PC performance that's solid as a rock, Quantex would be wise to get Bob Seger as its product pitchman.

—Bryan Del Rizzo

MAXIMUM PC KICK ASS! product

REAL WORLD BATTERY LIFE 01:42:00

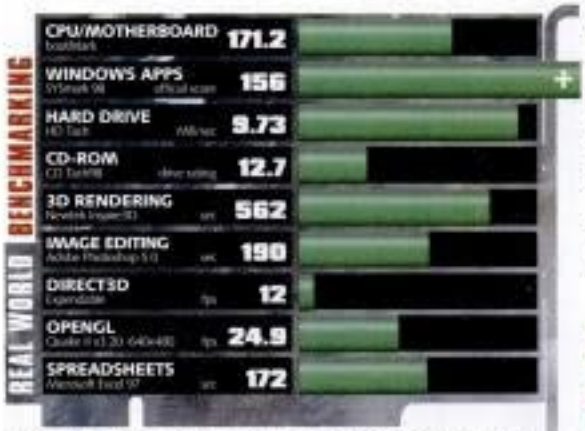
UNDER THE HOOD

THE BRAINS	
CPU	366MHz Intel mobile Pentium II
RAM	96MB SDRAM (expandable to 384MB)
I/O Ports	Dual PC card, parallel, serial, external monitor, single USB, single PS/2, TV-out, IrDA, mic-in, headphone-out, line-out
Modem	Built-in 56K V.90 modem
DISPLAY	
Videochip	ATI Rage LT Pro AGP with 8MB SDRAM
Display	14.1-inch active-matrix
Res/Depth	1024x786/32-bit
STORAGE	
Hard Drive	Toshiba 8GB Ultra DMA
DVD-ROM	Matsushita 4x SR-8171
SOUND	
Sound	ESS Maestro software wavetable/FM synthesis with 2MB sound library
Speakers	Side-mounted stereo
TIPPING THE SCALES	
Lap Weight	8 pounds, 13 ounces
Carry Weight	9 pounds, 10 ounces

BOOT 0:57 DOWN 0:04

DARE TO COMPARE

NOTEBOOK	PRICE
Fujitsu LifeBook L470	$3,100
Acer TravelMate 332T	$2,699
Sony VAIO 190	$3,100
Quantex I-1410	$2,599



NOTE: Because the I-1410 is our new zero-point system, this review uses the previous benchmarking scale. See page 82.

PLUSES
- 366MHz Pentium II
- Side-mounted speakers
- Direct3D-compliant
- DVD playback

MINUSES
- Single USB port
- Back breaker
- Difficult to awaken

MAXIMUM PC VERDICT

Price $2,599
Company Quantex
Phone 800.346.6685
URL www.quantex.com

9

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For definitions of Terminator words, hyperlink to the back of Maximum PC, or check out the Terminator online at www.maximumpcmag.com.

PlexWriter 8/2/20 CD-RW Drive

Quality. You've got our name on it.

Introducing the new 8X CD-ReWriter. Best in class record speed. Best of Plextor.

PlexWriter 8/2/20 CD-RW ReWriter Drive. It's the fastest of the fast. The latest high-performance archivist from the name that's synonymous with quality and reliability. Plextor.

With our multi-talented 8X Write and 2X ReWriter, you don't have to sacrifice CD-R performance to get CD-RW's ease of use. And, because it doubles as a hard-working 20X CD-ROM drive with 170ms access–it's three drives in one–not to mention one tough shell. An outstanding replacement for your outdated CD-ROM drives.

Archive up to 74 minutes of data in under 10, with drag and drop simplicity. And write without failure thanks to enhanced features like fool-proof media recognition that automatically adjusts power and burn time, fast SCSI burst rates, vibration dampening, superior cooling action, and a bigger-than-life 4MB buffer.

Bundled software supports CD to CD-R direct duping, digital audio capture/playback over SCSI bus or network, and Plextor CD Res-Q Hard Drive Disaster Recovery Software for total hard drive recovery from a bootable CD.

For reliability you expect at speeds that exceed, there's only one choice from the one and only. The new PlexWriter 8X CD-RW from Plextor. Now available with plain or black bezel.

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Don't Settle For Less

What's in a name? Call 800-439-5040, or visit http://www.plextor.com/contest/8220maxpc.html–enter to win a PlexWriter 8/2/20.

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Baseball Roundup '99

TWO SOLID HITS, ONE SINGLE, AND ONE BUNT

The Boys of Summer are back, with a pinch hitter in place of one perennial All-Star favorite. Why no *HardBall 7*, you ask? Because Accolade basically changed the box art, plopped in a few insignificant features, and reissued the game as *HardBall 6: 2000 Edition*. Bah! Give us new games, better graphics, and harder hits—that's what we say! And so, without further ado, the lineup for *Maximum PC*'s 1999 baseball season!

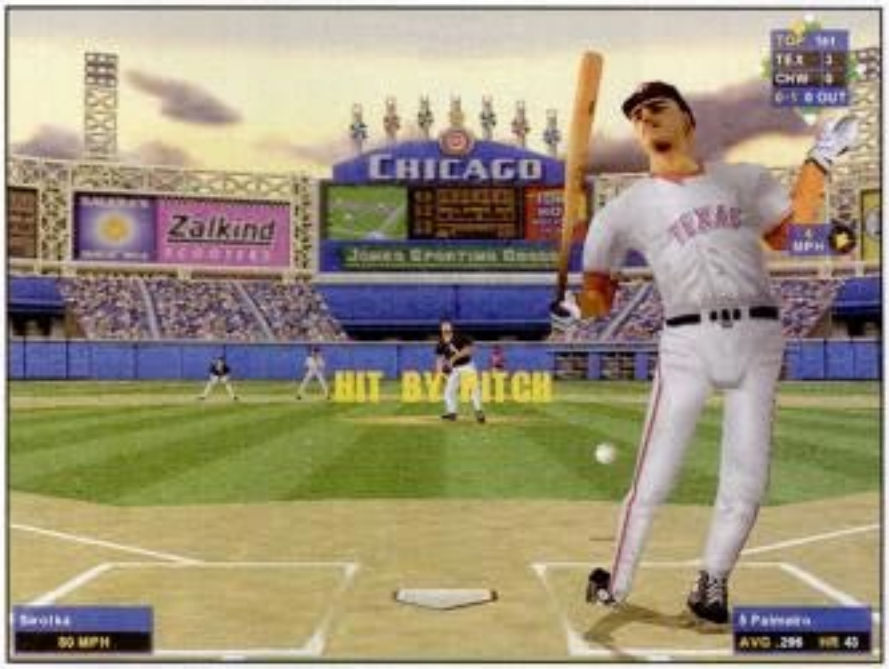
—Phil Lacefield Jr.

High Heat Baseball 2000

Last season's *High Heat '99* was the lowest-rated game in the bunch, taking a beating for horrid physics, awful animations, and its total lack of Major League Baseball licensing support. We dissed it up one side and down the other, kicking it back to the bush leagues so fast we were sure this was one rookie who'd never show face around these parts again.

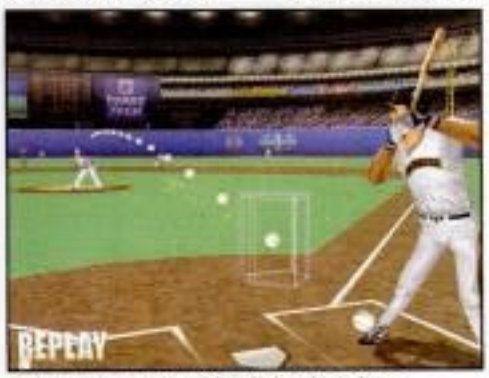
Man, what a difference one off-season can make.

High Heat 2000 returns to the plate with full licensing from Major League Baseball, a shiny new 3D graphics engine that puts the old 2D one to shame, and the biggest handful of cool animations we've seen since McGwire grabbed the keys to that classic 'Vette. Pitchers throw their arms up in shame on bad calls, outfielders squint and shrug when pop flies get lost in the sun, and teammates rush to the aid of beaned players. So what if the actual polygon modeling is still rather poor, and some of the batters' animated swings look like a fight with a wet noodle—at least this year *HH2K* feels like an actual game of baseball, not like playing with paper dolls. The only graphical feature truly lacking is multiple camera angles in a single-player game, but when you're having this much fun watching the show, who cares?



High Heat Baseball 2000 delivers, but beware of clipping problems like the one that mauled this batter's right foot.

Multiplayer games on a LAN or on the net are a snap to set up and a pleasure to behold at 1024x768. Plus, you're playing in stadiums that are immeasurably better looking in Direct3D and Glide than last year's were. *HH2K* antes up gorgeous sunsets, accurate cityscapes behind the outfield wall, and excellent play-by-play from the Giants' Ted Robinson—it all kept us coming back for more eye candy and sultry sounds. Every major-league stadium—and four that have yet to be built—is included, along with two extinct historical fields and two minor league parks, resulting in endless variety.



Here we prove once and for all that the judicious application of spit can cause an unsightly buildup of Ks.

But for all the graphical improvements over last year, what's even more impressive is *HH2K*'s complete makeover in gameplay. Control is simple and intuitive this time around, allowing precision placement of pitches and the transformation of many a Louisville Slugger into a pile of toothpicks. A variable umpire setting accurately portrays the occasional bad call, a minor league system actually helps your pitching staff, and wind speed and direction are factors during play. A new "career" play mode even allows you to farm out the portly old relievers and bring up fresh new prospects from the minors, greatly enhancing your 161-game season-winning abilities. Just try beating a 15-game losing streak with a worn-out bench! No other game portrays the true feel of baseball like *HH2K*.

Save for a few niggling quirks that are easily worked around, *HH2K* delivers a fast-paced, attractive, and downright fun game. Polish off the Golden Glove, folks, we've got ourselves a Comeback Kid here!

MAXIMUM PC VERDICT

Price $30
Company 3DO
Phone 800.336.3506
URL www.highheat.com

9

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Triple Play 2000

EA's latest in a long line of *Triple Play* titles comes back graphically strong but with horribly flawed AI. *Triple Play 2000* takes EA's excellent graphics of old and bumps up the resolution to 1024x768, while adding a new slate of beefy visuals. Animations include changing facial expressions, cud chewing, arm pumping, even Sammy Sosa's trademark kiss toward the heavens. We have to wonder, though: With all these gorgeous 3D renderings, why do the names and numbers on the backs of jerseys still look like smeared wet paint?

TP2K offers intuitive batting/pitching controls and stat management that ranges in difficulty from George Costanza to George Steinbrenner. However, setting up and accessing multiplayer games is hideously difficult, plagued with glitches and long delays. But computer AI is even worse: Playing the CPU in its easy or normal mode is just plain unchallenging. And if you choose talented mode, the computer will try to pick your runners off base up to 15, 20, 25 times in a row! This makes the game utterly worthless as you wait for a pitch to hit. Even worse, the AI pitcher has an amazing pick-off rate (even when you choose cautious baserunning), killing your rallies way too often. Sadly, manual baserunning mode, which would allow you to scurry back to base and avoid pick-offs, is almost impossible to master. Too bad the AI is so atrocious, because *TP2K* is a beautiful game with great sound effects.

Reggie Sanders rounds the Jacobs Field infield in Triple Play 2000, complete with victory wave.

MAXIMUM PC VERDICT

Company EA Sports
Price $40
Phone 800.245.4525
URL www.easports.com

4

Baseball 2000

So, here's our biggest question after kicking around Microsoft's latest hardball offering, *Baseball 2000*: What's the big deal? Sure, last year's version required a system with some form of 3D accelerator installed, making it impossible for some players to step up to the plate. Of course, the final results were well worth the price of admission considering the outstanding stadium and player renderings—both of which have carried over to this year's version and look even better in 1024x768. At 50+, *Baseball 2000* sports the highest framerates of the games we checked out. Take a look at the screen shots: You can actually recognize the mugs on most of the polygon replicas of your favorite players.

But that's just it, you see: *MSB2K* is damn near the exact same game as its predecessor, with just a few minor upgrades. Thom Brennamen hops into the color commentary booth, and this year a 3D accelerator isn't mandatory (although you will need a big burly system with loads of RAM and processing speed). But there's still no Internet play, still no way to avoid playing a complete season's worth of games, still no statistical measurement worth mentioning, still no way to avoid those disorienting camera flashes that help outfielders lose grounders. Obviously the bare-bones price tag is doing a lot to muffle the whining, and last year's game was pretty good in its own right, but leftovers are still just that: left over. No innovation here, just a shallow two-hopper to third for a gimme single.

In Baseball 2000, Mark McGwire's great-looking avatar looks just like...well, Mark McGwire.

MAXIMUM PC VERDICT

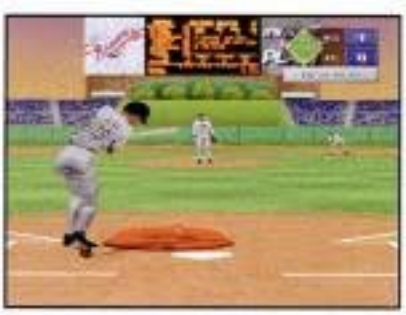
Company Microsoft
Price $20
Phone 888.218.5617
URL www.microsoft.com/games

6

Baseball Edition 2000

Sometimes, the draft unearths hidden treasures from Nowhere, USA. But most eager young rookies don't make the cut, despite their charm and credentials. Interplay Sports' *Baseball Edition 2000* is kinda like that: eager to please, fantastically pedigreed, but no real balls where it counts.

Take the graphics, for example. The stadiums are accurately rendered, but the sky is always dark and ominous, like a tornado is just about to blow into left-center field and plop a house down on the poor schlep out there waiting for something to happen. The much-ballyhooed Messiah engine is supposedly hard at work in *BE2K*, and the animations are quite nice to watch when players dive for line drives or slide headlong, Pete Rose–style, into third. Too bad the multipolygon player renderings mounted on that vaunted engine look like something your cleats dragged in, all smeary and lumpy and gross. Then there's the multiplayer support—or rather, the total lack thereof. And although current stats and rosters can be downloaded, playing the game can be more tedious than fun.



Not even Messiah can save Moises Alou from falling into this pit of despair. Ugh!

Interplay recently dropped the VR brand name in an effort to spruce up its sports franchise image. Too bad, because that recently deceased cousin had all the gameplay features, statistics management, and all-around rockin' fun that *BE2K* is sorely lacking. Single pitching views, dull sounds, a tepid home-run derby mode....

Sorry kid, better luck next year.

MAXIMUM PC VERDICT

Company Interplay
Price $40
Phone 800.468.3775
URL www.interplaysports.com

3

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Aural Arguments

SPEAKERS FROM MONSOON AND CAMBRIDGE GO HEAD-TO-HEAD

Readers opened a can of whoop-ass on us after discovering that none of the five speaker sets reviewed in our May audio feature were worth buying; not one setup was worthy of a verdict higher than 7. We promise that next time, we'll include recommendations for older products of merit if none of the new ones pass muster. But since that roundup, Sonigistix and Cambridge SoundWorks sent us their latest and greatest speaker setups, one of which spews audio goodness.

—Rick Popko

Sonigistix Monsoon MM-700

Reviewed in our November 1998 issue, the Monsoon MM-1000s garnered a 7 rating from the inimitable Andrew Sanchez. His main point of contention was the audible snap between tracks. Unfortunately, the same snap mars the MM-700s. This problem needs to be addressed, but it doesn't bother us significantly.

The MM-700s are a low-end version of the MM-1000s, with Monsoon cutting a few corners to reach a competitive price: The subwoofer has been dropped to 22 watts and the satellites to 11 watts.

What makes the MM-700s interesting is the satellites' planar technology. Instead of a paper-cone diaphragm pushing audio out of the speaker, a piece of plastic mylar held by the clamshell casing vibrates, producing audio. The 8x5-inch design opens up a broader audio sweet spot than that found in most cone solutions. Unfortunately, you quickly lose that sweet spot when you step to the right or left of either speaker. And you don't want to hang these speakers on the wall, because sound flows from both the front and back of the satellites. Audio crosses over from the satellites to the sub at about 90Hz. The downward-firing subwoofer with a 5-inch cone drops off the scale at about 40Hz.

The MM-700s lack the warmth of traditional cone speakers, but they have a much broader sweet spot.

Planar technology kicks out awesome sound in a wafer-thin design.

These speakers are best suited for those with an ear for treble. They worked well as monitor speakers when attached to a Kurzweil keyboard, though they occasionally gave an annoying vibration when playing certain piano notes. We checked this against a piano solo recorded on CD and heard the distortion there as well.

Overall, the MM-700s are a gentleman's speakers. They distort easily, so you won't want to crank them up too high. Still, we'd take these speakers over 90% of the setups we've come across recently.

MAXIMUM PC VERDICT

Price $179
Company Sonigistix
Phone 604.271.2237
URL www.sonigistix.com

8

Cambridge SoundWorks FPS2000 Digital

Being Cambridge SoundWorks fans, we *wanted* to like these speakers. The four 3-inch cube satellites were cool, but their 7-watt output just didn't measure up against the 11-watt output of the Monsoon satellites. On our piano test, we heard the same crackly vibrations the Monsoons emitted. And there's an audible hiss when you turn the volume up too far. On the other hand, the 2000s had less distortion at higher volumes than the Monsoons.

The main problem with the 2000s is that either the satellites are too powerful for the sub, or the sub is too underpowered for the satellites; everything sings together at only one setting. If you turn the volume up too much, the satellites overpower the sub, causing bass tones to almost disappear. Another drawback is the satellites' crossover frequency: Sound dropped off the sats at about 200Hz. The sub's bass response could sink to about 50Hz, but the Monsoons beat it by about 10Hz.

The 2000s' selling point is that they're "digital." Not USB digital, though—Creative Labs' Sound Blaster Live! digital. You'll need a Live! card to take advantage of it. About the only thing the digital port did was lower the amount of hiss flying out of the sats at higher volumes; sound quality didn't dramatically improve like we'd hoped. Sad to say, the thing we liked best about these speakers was the volume controller, which lets you adjust the total volume as well as the amount of volume you want sent to the front and rear speakers. Perfect for tweaking your ideal sweet spot.

We've always liked Cambridge's speakers, and we hoped that when Creative Labs purchased Cambridge, the quality of its products wouldn't drop. But with what we've heard lately, it seems our fears are bearing out.

The FPS2000s offer a cheap five-piece setup, but you get what you pay for.

MAXIMUM PC VERDICT

Price $199
Company Cambridge SoundWorks
Phone 800.367.4434
URL www.hifi.com

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Castlewood Orb

WHAT REMOVABLE MEDIA SHOULD BE

The Orb kicks the competition's ass, in price and performance.

Orb is light years ahead of Iomega's Jaz in engineering. Built using the magnetoresistive (MR) head technology developed by IBM, Orb more closely resembles a hard drive. Castlewood also employed PRML channels to reduce side noise and stray magnetism from adjacent channels. This technology and the technical complexity of dealing with the loose platter in the cartridges delayed the product's release. Ultimately, though, these technologies paid off in a platter with an areal density that could grow to deliver even larger, faster drives.

Orb leads its rivals in performance and capacity, but as a new technology, its reliability and portability are still unproven. Though in our real-world test it didn't achieve its advertised throughput of 12.2MB/sec, Orb's read/write speeds of 9.4/8.7 MB/sec blow away Jaz's paltry 5.4/1.1MB/sec. Its random-access time is 2ms short of Jaz's 18.9ms, but its read burst speed was double Jaz's, averaging around 15MB/sec. Our real-world benchmarks tell all, with the Orb copying 1.87GB of data in 8 minutes and 57 seconds where the Jaz took an outrageous 1 hour 13 minutes. This is to be expected, given that Orb writes data eight times faster than Jaz. For digital video work, the Orb delivers fairly consistent performance across the platter, although it dips in the middle when the head compensates for heat expanding the platter's aluminum substrate. In general, you should be able to encode video at 7MB/sec without dropped frames.

Each 3.5-inch Orb cartridge holds 2.2GB and ships with FAT16 to support all Windows platforms. The cartridges are thinner than Jaz media and feel less sturdy. Also, we found the loading mechanism awkward. Basically, you load media by holding down the door and firmly pushing the media until it clicks into place. An auto loader that grabs the media and inserts it would be more graceful. As time passes, we'll learn more about the drive's and cartridge's reliability. Also, portability will depend on the rate at which Orb is adopted—installed base is everything for removable storage products. Right now, Castlewood's name recognition is next to nil—not good for a budding product.

Included is Orb Tools, which offers one-click access to utilities such as disc and file copy, write-protect, and status. You can also make a cartridge nonremovable, so it acts like a typical hard drive.

Castlewood currently ships both the IDE version we tested and a parallel-port version with maximum read speeds of around 700K/sec to 900K/sec. A SCSI version will be released shortly (pending compatibility with host controllers), and 1394 and USB versions are being considered.

In July 1999, Iomega filed a lawsuit against Castlewood for theft of intellectual property relating to its Jaz drive technology. True or not, it shows that Iomega is worried about Orb. It should be, because Orb kicks Jaz's butt. Although its current installed base is small, this technology has plenty of room to grow, and we plan on spreading the news.

—Sean Cleveland

THE SPECS

MEDIA SIZE	2.2GB
NUMBER OF DISCS/HEADS	1/2 (coil for write and MR head for read)
SPINDLE SPEED/ AREAL DENSITY	5,400rpm / 1.7Gb/in2

PLUSES

- Fastest removable backup yet
- Very reasonably priced
- Hard drive engineering ensures better reliability

MINUSES

- Doesn't meet advertised performance
- Not ubiquitous
- No SCSI, 1394 or USB versions yet

DARE TO COMPARE

DRIVE MANUFACTURER	ORB CASTLEWOOD	JAZ IOMEGA	DVD-RAM HIVAL/ PANASONIC
Media Capacity	2.2GB	2.0GB	2.6GB (per side)
Price per Drive	$200	$350	$540
Price for Media	$30	$125	$35 (dual sided)
Connection Types Available	EIDE	SCSI-2 Parallel Port, SCSI-2[1], USB[1], 1394[1]	SCSI-2
Average Read Speed (MB/sec)	9.4	5.4	1.3
Average Write Speed (MB/sec)	8.7	1.1	0.57
Random Access Time (ms)	21.7	18.7	199
Read Burst Speed (MB/sec)	14.7	8	6.4
CPU Utilization (%)	2.4	0.8	2.3

NOTE: [1]Coming soon.

MAXIMUM PC VERDICT

Price Drive $200; Cartridges $30 each
Company Castlewood
Phone 925.461.5500
URL www.castlewood.com

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CUSTOMIZING YOUR MECH

New to *MechWarrior* is the ability to customize your Mechs with materials you've scavenged from the battlefield.

Collect valuable parts after a clean kill.

First of all, make sure you're playing "honorably," that is, without unlimited ammo or invincibility. Then, simply go out and start blasting away at enemy Mechs.

The debriefing screen lets you allocate found parts.

Once you've completed your mission objectives, you're given the option at the debriefing screen to allocate salvage and customize your Mech. Keep a careful eye on the maximum capacity of your MFBs as you "Allocate Salvage," as they have a limited carrying capacity and you'll want to keep only what you think you'll be able to really use later.

You may have allocated a bunch of new parts, but your skin remains the same.

At the Mech Lab, you can take advantage of all that salvage and start assigning weapons, heatsinks, and various other goodies to your hard points. Note that while you can change the skin of your Mech, no amount of weapon modification will make it look any different.

MechWarrior 3

GO AHEAD, MECH MY DAY

MAXIMUM PC KICK-ASS! product

Activision's *MechWarrior 2* was the greatest Mech to ever grace a hard drive, so MicroProse had some mighty big shoes to fill—50-ton ferro-fibrous metallic shoes, to be exact. But *MechWarrior 3* not only fills those shoes, it takes a giant leap onto the next level of Mech battling sims.

What makes *MechWarrior 3* so brilliant? For starters, it looks great. Nay, it looks mind-blowingly fantastic. Crank the proprietary polygon 3D engine up to 1024x768 and prepare to have socks disengage from body. While there's no mistaking that this is another *MechWarrior* generation, once you pull that trigger you'll realize just how much things have changed. Launched missiles produce ultra-cool translucent smoke effects and eye-shattering pyrotechnics as they find their target. And when the fury of your ammo makes contact, watch out: Limbs fly off heavily hit Mechs in a fiery explosion, leaving nothing but torn metal and exposed cables. Adding to the game's atmosphere is creative use of DirectSound3D sounds that are truly awesome. The game also feels great when you're using a force-feedback joystick.

THE SPECS

3D SUPPORT
Direct3D
DirectSound3D
Force-feedback
MULTIPLAYER
IPX (two to eight players)
TCP/IP (two to eight players)
Modem
Serial

PLUSES

- Killer graphics
- Piloting a 50-ton behemoth feels realistic
- Deformable terrain and environment
- Solid enemy AI

MINUSES

- Wide-open terrain still looks blah
- Overwhelming keyboard commands

You can run but you can't hide. Buildings, terrain, and even fallen Mechs can serve as shields in your strategy.

But *MechWarrior 3* isn't all style and no substance. There's plenty of meat beneath its cold metal flesh. A new targeting system allows you not only to zoom in on your target, but also to focus on particular body parts. Once your enemy is destroyed, you can salvage its parts and use them on your own Mechs. You can also have the field-repair vehicles fix you up during a mission, if you're willing to risk powering down for that long. Or you can tweak your machine during battle, to reroute power to your shields, among other things. And it's not just a bullet-fest to see who falls first—you must also use the changeable terrain and structures to your advantage. You can blow holes in the ground to slow down an escaping Mech or shoot at debris above so it comes crashing down on him.

During missions, you can command as many as three Lancemates to follow attack or defend as necessary—and you will find it necessary, because the enemy AI is solid. Instead of simply barreling down on top of you, Mechs may choose to flee when the going gets rough and wait for the assistance of their healthier Mech mates.

You can target specific body areas by using your keypad, leaving behind cable and twisted metal.

Getting far too up-close and personal with the enemy.

With *MechWarrior 2*, fans had to wait a year for multiplayer Mech. Thankfully, all the multiplayer goodies are here in *MechWarrior 3*, including Free-For-All and Team Play. As expected, it's a blast, though those expecting the frenetic pace of *Quake* will be disappointed. You are dealing with 100-ton machines, after all.

All this adds up to the new king of the Mech mountain. Not only has *MechWarrior 3* managed to fill the shoes of its older brother, it's also laid down its own footprints for others to follow.

—Shane Mooney

MAXIMUM PC VERDICT

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Company Microprose
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URL www.microprose.com

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Midtown Madness

MOTOR MAYHEM MINUS MISDEMEANORS

In the vein of *Monster Truck Madness II* and *Motocross Madness* comes *Midtown Madness Chicago Edition*, a no-holds-barred racing game that has you tearing up the beautifully rendered 3D streets of downtown Chicago.

Midtown Madness is easily mastered and quickly played through. While you can race the machine or up to eight online players, it's more fun to go off course and wreak havoc on your fellow drivers. The police manhunt that ensues becomes more difficult to outrun as your car becomes more damaged.

The level of graphic detail in *MM* is impressive. We appreciated the gorgeous scenery and inclusion of notable landmarks such as the John Hancock Tower, Wrigley Field, Shedd Aquarium, and the El. We also liked physics accoutrements such as newspapers flying, garbage scattering, and changing traffic patterns. While not very convincing, each car has its own physics model, so rolling the Caddy looks and feels different from rolling the bus. Sadly, *MM* is strictly PG fare, so pedestrians dive safely out of your way when you try to run them down.

While the game's resolution can climb to 1280x1024 using a Matrox G400, it had a hard time recognizing our TNT2 and defaulted to 640x480. Voodoo² users will get the best performance at 800x600. Even with these graphic inconsistencies and limited replay value, *Midtown Madness* is a lot of fun.

—Phil Lacefield Jr.

Yee haw! Midtown Madness lets you go off course and cause total chaos on the Chicago highways.

PLUSES
- Addictive gameplay
- Realistic city graphics
- Convincing physics
- Cool multiplayer levels

MINUSES
- Short single-player scenarios
- No blood-n-guts
- Graphic card anomalies

THE SPECS

3D CARD SUPPORT
Direct3D

MULTIPLAYER
TCP/IP, IPX, Modem
8-player max

3D SOUND
DirectSound

MAXIMUM PC VERDICT

Price $40
Developer Angel Studios
Publisher Microsoft
Phone 888.218.5617
URL www.microsoft/games/midtown

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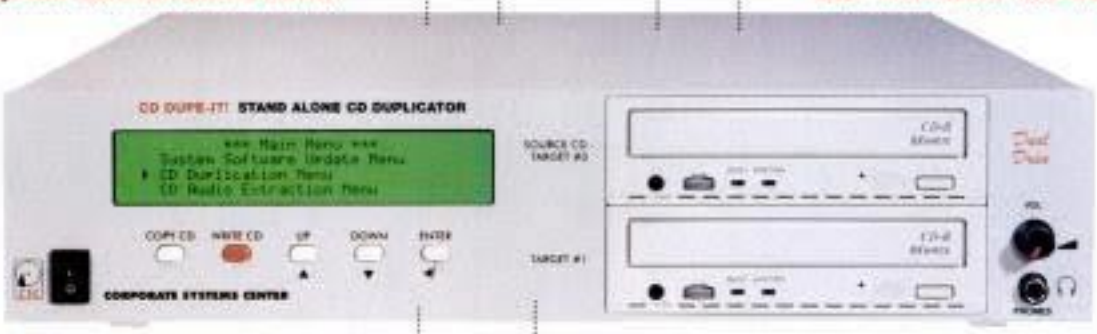

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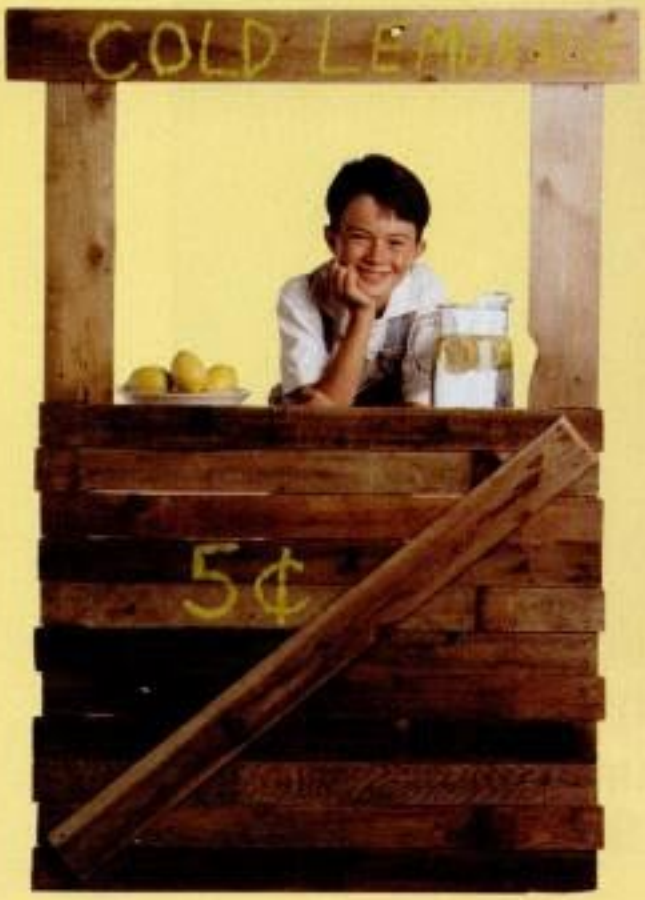

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TERMINATOR

Tech Terms Revealed ▶

Technical terms found throughout MAXIMUM PC are underlined and in blue. Hyperlink back to here for revelation and further explanation. Terms appearing in **blue** within the Terminator are updated definitions of previously explained concepts.

A

AC-3 Also known as Dolby Digital 5.1, AC-3 is a method of encoding sound to five discrete or separate channels, mainly front left and right, front center, and rear left and right.

Active Server Pages A specification for a dynamically created web page that contains either Visual Basic or Javascript code. Active server pages are similar to CGI scripts, but they enable Visual Basic programmers to work with familiar tools.

AGP 2x AGP is an expansion bus developed by Intel specifically for the videocard subsystem. It operates independently of the PCI bus and normally runs at 66MHz (i.e., 1x). When you see multipliers attached to AGP, such as 2x or 4x, they refer to how much faster the bus will run, so 2x means 66MHz x 2, or 133MHz.

API Application Programming Interface. A collection of subroutines—usually part of an operating system—that application programs can call upon to perform common tasks. For example, a program might call on an API routine to display a window on the screen. APIs reduce the amount of code that programmers have to write.

areal density The amount of data that can be packed onto a storage medium. Areal densities are generally measured in gigabits per square inch. Generally, the higher areal density, i.e., the more data that can be packed into a single square inch, the better.

AT A large motherboard formfactor, often used in multiprocessor workstations.

ATA33/66 Enhanced versions of the IDE I/O interface that support 33MB/sec. and 66MB/sec, respectively. This technology helps IDE hard drives achieve SCSI-like speeds.

ATX The motherboard formfactor found in most "performance desktop" systems.

B

BIOS Basic Input/Output System. Software that contains your computer's most rudimentary instructions on how the operating system communicates with hardware. Your BIOS runs at startup, configures devices, then boots the OS. Because the BIOS is so integral to getting your computer started, it's stored on a separate ROM chip instead of on your hard drive, isolating it from crashes.

C

Cascading Style Sheets A language applied to HTML that controls the style of a document: which fonts and colors to use, how much white space to insert, etc. Specifying the style at the top of the document applies it to all the elements on a page.

CD-R Compact Disc Recorder. A CD drive device that can not only read, but also record data and music onto special media.

clock multiplier CPU speeds are determined by multiplying the speed of the system bus by a variable number—the clock multiplier. For example, a 550MHz CPU running on a 100MHz system bus uses a multiplier of 5.5.

clock speed The operating speed of a microprocessor chip or a chip interface as measured in clock cycles per second; regulated by a "clock" or oscillator that synchronizes operations. During each clock cycle, transistors switch on and off to redirect electrical current through a chip's circuits. The faster this happens, the faster a program runs. Synonymous with clock frequency, it's usually expressed in megahertz (200MHz equals 200 million cycles per second).

command tag queuing A feature of the SCSI-2 protocol that allows device controllers to accept and queue multiple commands from multiple host processes without waiting for a pending I/O request to be completed, resulting in a more efficiently utilized SCSI bus. Basically, it allows devices to immediately accept and execute other commands while data that has already been read or written is sent back up the bus to the SCSI host adapter.

console game Your basic "video game." Runs on a self-contained, non-upgradable box, such as the Nintendo N64 or Sega Saturn, instead of on a PC, which can be upgraded with new hardware.

core-logic chipset Two or more chips on the PC motherboard that connect the CPU to other system devices. The system chipset defines many of the features of a PC: how much main memory (RAM) it can hold, how many expansion slots it has, how much memory it can cache, and so forth.

D

Direct RAMBUS Short for Direct Rambus DRAM (developed by Rambus, Inc), RAMBUS is a new high-speed memory technology that can transfer data at 600MHz. Both Intel and AMD would like to use this memory with their CPUs, but manufacturing problems are slowing the memory type's introduction.

double data rate SDRAM Also know as DDR SDRAM. A type of memory that can transfer data on both edges of the clock cycle—for, you guessed it, double the performance.

drive cache A small amount of memory installed in a hard drive or CD-ROM drive that stores recently accessed data. When a program looks to a drive for fodder to chew on, it first turns to the cache. Retrieving data from solid-state cache is much faster than retrieving data from a mechanical drive.

DSL A broadband Internet bandwidth technology that uses plain-old telephone wires to transmit data at speeds up to 1.5MBps.

DSP Digital Signal Processor. A special type of microprocessor chip that's optimized for performing repetitive operations on large sets of data. DSPs are often used for communications, networking, multimedia, and other specialized tasks.

DualBus Specifically refers to the two independent 128-bit processing pipelines working inside the Matrox G400 graphics processor.

Dynamic HTML HTML for 4.0 and later browsers that allows web pages to become more "interactive" via animations and other effects. These browser-specific behaviors are based on the following standards: Document Object Model (DOM), HTML, Cascading Style Sheets (CSS), and EcmaScript (standardized JavaScript).

E

environment-mapped bump-mapping Adds detail to a polygon surface by laying down a third texture map, or bump map, in addition to the base texture and the environment map.

environment-mapping A texture effect that applies a reflection of the surrounding game environment on the texture itself. This is useful for giving textures a highly reflective appearance, such as simulating chrome.

Extensible Markup Language Also known as XML. An extention to the HTML spec that allows designers to customize their own tags.

F

FAT A DOS- and Windows-based file system that tracks the location of data on a disk using File Allocation Tables (FAT), which are tables of numbers that indicate the status of a cluster or the location of the cluster belonging to a file. A directory table is used to track file names, extensions, date, and other info, including the FAT address of where the file starts. When a file is requested, the table is checked, and the cluster containing the file is located. The address of the next cluster is also located if the file is larger than a single cluster, until an END OF FILE designator has been reached.

FAT16 A 16-bit DOS and Windows file system (see FAT) that varies cluster sizes based on hard drive size. Cluster sizes range from 2K (for drives up to 127MB), to 4K (255MB drives), 8K (511MB drives), and 16K (1GB drives). And 32K (for drives up to 2GB). The ultimate capacity of a FAT16 partition is 2GB.

FAT32 A 32-bit file system that was introduced with Windows 95 OSR2, it uses 4K cluster sizes for all drive sizes with a maximum capacity of 8GB.

floating-point A fractional number, such as 9.95 or 98.6. Computers have a more difficult time working with floating-point numbers than they do with integers (whole numbers), but the higher precision of floating point is required for some operations.

FPU Floating-point unit. A function unit (collection of circuits) in a microprocessor that executes floating-point instructions. A floating-point number is a fractional number, such as 9.95 or 98.6. Computers have a more difficult time working with FP numbers than they do with integers (whole numbers), but the higher precision of FP is required for some operations.

frontside bus The main system I/O (input/output) interface that connects a microprocessor to other system devices. Typically, it allows the processor to communicate with main memory (RAM), the system chipset, PCI devices, the AGP card, and other peripheral buses. It also connects to the Level 2 cache unless the processor has a backside bus.

I

integer A whole number, i.e., 1, 2, 3, etc. Computers can manipulate integers much faster and more accurately than they can manipulate floating-point numbers (fractions), but integers aren't precise enough for some operations.

L

L1/L2 cache Stands for Level 1/Level 2 cache. The fastest memory available to a microprocessor. L1 is integrated in the processor die; L2 can be located on the die or on a nearby chip. Because the CPU runs faster than the memory bus—say, 400MHz versus 100MHz—cache becomes useful for temporarily storing instructions and data, making sure the CPU has a steady supply of material to chew on while memory catches up.

Level 2 cache The second-fastest memory available to a microprocessor (second only to the Level 1 cache). It usually consists of SRAM chips near the processor, although some recent processors have on-chip L2 caches. Also known as secondary cache.

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M

Magnetoresistive Magnetoresistive heads use separate read and write elements for optimized read and write capabilities. The read element is composed of a thin film material whose resistance changes when near a magnetic field. This in turn produces a stronger signal that allows for greater areal densities and larger disk capacities.

Master A single IDE bus can support two devices—a "master" device and a "slave" device (the slave device is directly connected to the master device, receiving I/O via a pass-through cable). Only master devices can boot-up the computer.

MediaGX A CPU from Cyrix that integrates sound, video, and core-logic control on the processor die.

multitexturing The process of applying multiple textures to polygons in a model.

N

northbridge The single chip in a core-logic chipset that connects the CPU to the system memory and the AGP and PCI buses.

O

OpenGL ICD OpenGL Installable Client Driver. The original OpenGL driver model. Partial implementation allows a 3D accelerator to run OpenGL-accelerated 3D games, e.g., *Quake II*. Full implementation allows the card to support OpenGL acceleration in 3D rendering applications (e.g., 3D Studio Max).

P

P6 A CPU architecture family, of which the Pentium Pro, Pentium II, Pentium III, Celeron, and Xeon processors are currently members. The P6 core debuted with the Pentium Pro in the first half of 1995. It is defined by a deep pipeline that addresses cache bottlenecks, closely coupled and on-die L2 cache, fixed-length instructions called "micro-ops," and out-of-order execution. For a detailed explanation of these terms, please see our CPU White Paper in the Re:Print section of www.maximumpcmag.com.

particle effects Effects produced by 3D engines, such as sparks, smoke, or very small objects that are usually in motion.

PRML channels The Partial-Response, Maximum-Likelihood technique differentiates noise from a good signal by measuring the rate of change at various intervals of the rising waveform. It uses digital signal processing (DSP) to reconstruct data and increase the number of bits that can be recorded.

R

RAID Redundant Array of Independent Disks. RAIDs are stacks of hard disk drives usually found in servers. RAID arrays essentially serve two purposes: 1) They protect important information by redundantly storing it on multiple drives—so even if one drive fails, another drive will contain its exact mirror. 2) Disk striping, a method that interleaves bytes across multiple drives, allows more than one drive to be read and written to simultaneously, increasing the data rate by almost a multiple of the number of drives used.

RAMDAC Random Access Memory Digital to Analog Converter. The chip on a videocard that converts the bits of a digital image into an analog signal. It maintains the color palette and determines refresh rates. The faster the RAMDAC speed (in megahertz), the higher the refresh rate your system can handle.

RISC Reduced Instruction-Set Computing. RISC is an architectural design style for microprocessors that tries to maximize performance by encoding program instructions in a fixed-length format, and by using simpler instructions that execute in fewer clock cycles.

ROM Read-Only Memory. A memory chip that stores specific data that cannot be written over (this as opposed to Random-Access Memory, or RAM, which can receive and flush data on the fly).

S

SDMI Secure Digital Music Initiative. Created by the Recording Industry Association of America to bring together the worldwide recording, consumer electronics, and information technology industries to develop new open technology specifications for digital music distribution. SDMI supporters include Compaq, Diamond Multimedia, Creative Labs, Yamaha, Sony Electronics, Samsung, and Microsoft.

set-top box A device that provides additional functions to a TV. The simplest set-top boxes receive cable TV channels. More sophisticated boxes may decode digital TV signals, connect to satellite dishes, and even provide some computerlike functions, such as e-mail and web browsing.

SIMD Single Instruction Multiple Data. A processing strategy that tells a single programming instruction to perform the same operation on two or more pieces of data. Intel's MMX and SSE extensions, and AMD's 3DNow! extensions, all use SIMD to boost performance in multimedia games and applications.

single-cycle Usually associated with 3D rendering. Think of pixel processing as being like a conveyer belt, where the pixel data goes down the line and is given attributes along the way (such as color, level of transparency [alpha], positioning in the z-axis, lighting, and so forth). A single rendering cycle is just such an operation, with the final output being sent to a rasterizer, where it is displayed on screen. Certain attributes, such as bump-mapping, environmental reflections, or lighting, may require a second run through this pipeline before heading off into the rasterizer for display. This second run down the conveyer belt is time-consuming and processor-consuming. If a 3D accelerator has a second processor that applies that second attribute alongside all the other attributes during that first cycle, the pixel can be processed in a single-cycle, thus speeding up the process.

slave A single IDE bus can support two devices—a "master" device and a "slave" device. The slave device is directly connected to the master device, receiving I/O via a pass-through cable. Only master devices can boot-up the computer.

SMP Symmetric Multiprocessing. SMP systems have two or more microprocessors and an operating system that tries to distribute workloads evenly among the processors.

Socket 370 A new 370-pin CPU interface introduced by Intel in 1998. Sometimes it's called Socket 9, because Socket 8 was the Pentium Pro's interface and Socket 7 was for Pentium-class CPUs. Socket 370 is replacing Slot 1 on many newer motherboards.

soft jumpers Toggles in a motherboard BIOS that allow you to adjust bus speeds and the CPU multiplier—all without having to tweak any physical "hard jumpers" located on the motherboard itself.

source code The program instructions written by programmers. Programmers use a development tool to write, compile, test, and debug their source code. The compiler turns source code into object code, which the computer executes.

southbridge The chip in a core-logic chipset that controls the IDE bus, USB, plug-n-play support, the PCI-ISA bridge, keyboard/mouse controller, power management features, and other sundry features.

specular lighting Lighting that has the qualities of a speculum, or mirror; a specular object has a smooth, reflecting surface.

SSE Steaming SIMD Extensions. A set of 70 instructions from Intel that speed up the Pentium III's floating-point, integer, and memory streaming power. SIMD stands for Single Instruction Multiple Data. This processing strategy tells a single programming instruction to perform the same operation on two or more pieces of data. SSE is similar to AMD's 3DNow! but brings more to the table via memory streaming enhancements. As is the case with 3DNow!, games and applications must be optimized for SSE to take advantage of the performance boosts.

Stencil buffer A small chunk of closely coupled RAM used for storing data that will be quickly compared to incoming data and changed as needed. A stencil buffer could be used to hold data for simulating realtime changes in a chunk of a scene, such as a mirror or shadows. Any changes can be quickly changed and the output can accurately reflect these changes.

S3 texture compression Built into DirectX6 and available as an OpenGL extension, S3 texture compression is a hardware scheme that achieves 6:1 compression ratios.

superpipelining Essential for scaling processors to higher frequencies. Similar to an automobile assembly line, superpipelining breaks up the execution of a complex instruction into multiple simple stages so that less work is done per stage and each stage completes as quickly as possible. As the frequency of the processor increases, each pipeline stage can keep pace, because its task is relatively simple. Because there are multiple simple stages, it's important to keep the pipeline operating on the correct instructions. This requires good branch prediction—if the pipeline stages are working on the wrong instructions, the entire pipeline must be flushed clean.

superscalar A superscalar microprocessor can execute more than one program instruction at a time. Multiple function units make this possible.

system on a chip A microprocessor chip that has extra functions normally provided by auxiliary chips and components. Those functions might include memory control, peripheral interfaces, graphics, sound, and more. Such highly-integrated chips are usually designed for low-cost PCs or non-PC information appliances.

T

tag RAM Memory chips that store memory addresses for use by a microprocessor's Level 2 (L2) or Level 3 (L3) cache. The memory addresses point to locations in main memory (RAM) from which the data in the cache came. Without enough tag RAM, the cache can "see" only a limited amount of the system's total memory.

Terminator A synthetic flesh-covered cyborg designed to kill specific, pre-programmed prey.

texture The surface graphics on a 3D object. Without textures, 3D objects look like naked skeletons of polygons. Textures add realism—a brick wall, the skin of a lizard, or the gleaming metal surface of a spaceship. A 3D program stores a texture as a graphic pattern and applies it to the structure of polygons.

370-pin socket An unofficial term for a 370-pin CPU interface introduced by Intel in 1998. It's sometimes called Socket 9, because Socket 8 was the Pentium Pro's interface and Socket 7 was for Pentium-class CPUs.

U

Ultra 2 Doubles the total bus throughput of Ultra Wide SCSI from 40MB/sec to 80MB/sec, by increasing the clock rate to 40MHz.

V

volumetric fogging Atmospheric noise effect with depth, in addition to a defining plane. Frequently employed in 3D scenes to reduce polygon count and avoid "pop-up" scenery.

W

warez Illegal software that typically requires illicitly obtained registration codes to run.

WebPad A hand-held, battery-powered computer with a large LCD screen but no traditional keyboard. It connects wirelessly to the Internet. WebPads are intended to replace PCs for some mobile applications. They exist mostly as prototypes, not as finished products.

words Don't you know about the bird? Well, everybody knows that the bird is the word! Pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-pa-ooma-mow-mow, papa-ooma-mow-mow.

X

x86 A microprocessor architecture invented by Intel and widely copied by other companies. The 486, Pentium, Pentium Pro, Pentium II, Celeron, Xeon, AMD K6, K6-2, K6-III, Athlon, Cyrix M II, and Centaur WinChip are all x86-compatible processors. The first x86 chip was the 8086 in 1978.

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MAXIMUM PC

COMING NEXT MONTH

AMD'S ATHLON

As a follow-up to this month's feature, we give you the first reviews of machines based on AMD's newest track star, and compare them to Intel's swiftest runners. Will AMD finally beat Intel to the tape? Only those seated in MaxStadium will cheer the winner.

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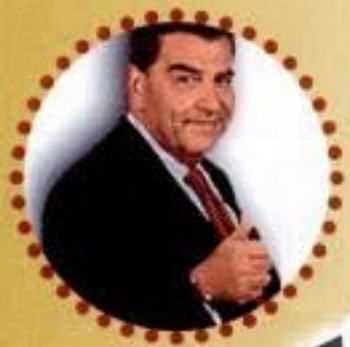

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Don't let technical obsolescence emasculate your surging electronic man-box! If you want next-gen 3D power today, you'll buy a videocard that just plain *doesn't make sense.* Bitchin' *fast!*3D^{2000} comes correct with not one, not two, but ALL FIVE of today's hottest 3D chipsets—and they're all jimmied together in some kind of nutty, five-way, scanline-interleave bouillabaisse. It shouldn't work… *but it does.*

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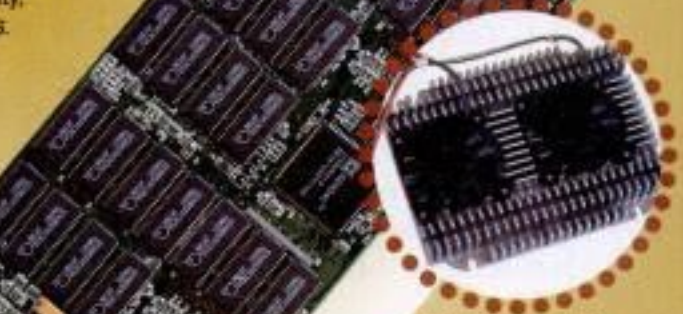

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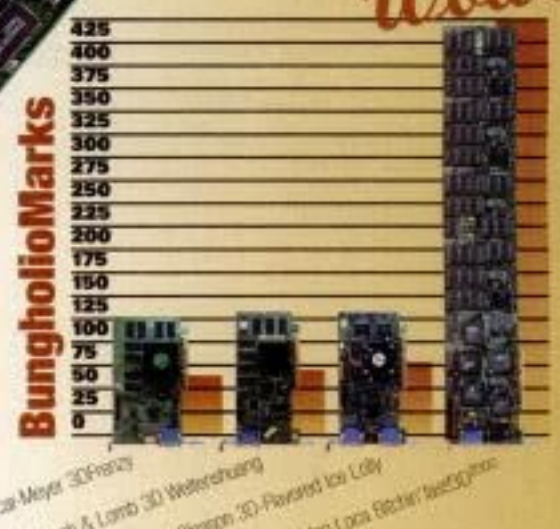

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- 2X AGP 4MB ATI RAGE Mobility™ P 3D Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Internal 56K Capable[11] v.90 Fax Modem
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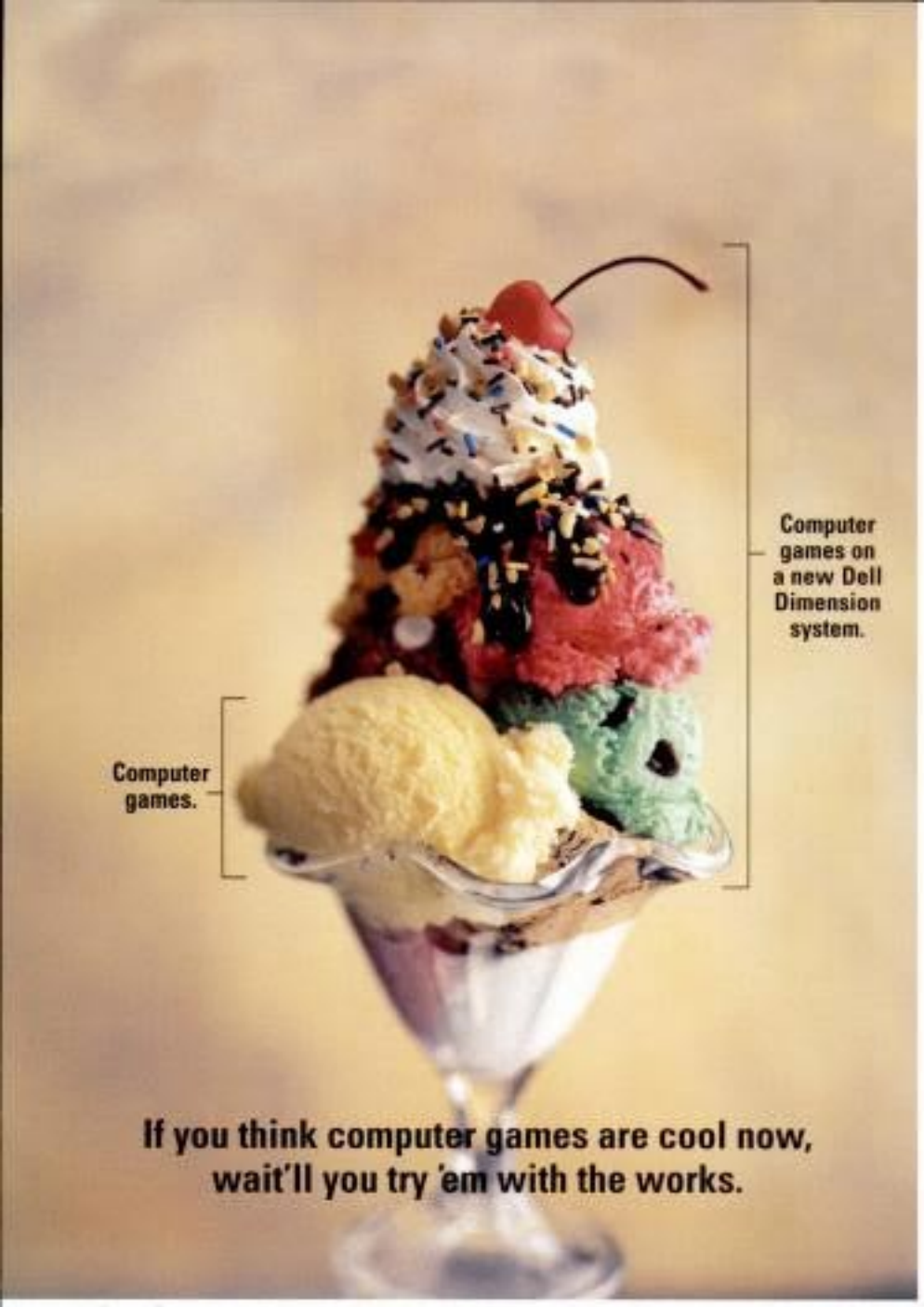
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- 40X Max[3] Variable CD-ROM Drive
- Turtle Beach Montego II A3D™ 320V Sound Card
- harman/kardon HK-195 Speakers
- 3Com® USR V.90[11] PCI Telephony WinModem
- MS® Works Suite 99 with Money 99 Basic; McAfee VirusScan; MS Windows® 98 Second Edition
- Dell QuietKey® Keyboard
- Logitech MouseMan® Wheel (PS/2v)
- 3-Year Limited Warranty[2]
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